DISSERTATION

FOR THE AWARD OF DEGREE

MASTER OF SCIENCE

In

MEDICAL IMAGING TECHNOLOGY

SESSION 2022-2024

EVALUATION OF KNOWLEDGE AND AWARENESS ABOUT TELE-RADIOLOGY IN RURAL AREAS OF GHAZIABAD, U.P., INDIA

BY

KM REETU RANA

ENROLMENT NO- (950122465)

MASTER OF SCIENCE

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DEPARTMENT OF RADIO-DIAGNOSIS

SANTOSH DEEMED TO BE UNIVERSITY

NO. 1, SECTOR 12, SANTOSH NAGAR, GHAZIABAD-201009,

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ABBREVIATIONS

S. No.	Abbreviations	Full-Form
1.	SFTP	Secure File Transfer Protocol
2.	CHC	Community Health Center
3.	DH	District Hospital
4.	DICOM	Digital Imaging and Communications in Medicine
5.	ICU	Intensive Care Unit
6.	MRI	Magnetic Resonance Imaging
7.	PACS	Picture Archiving and Communication System
8.	SDH	Sub-district Hospital
9.	TAT	Turn-around Time

ABSTRACT

Background: It is very hard for people living in villages in India to get special healthcare services like X-rays and scans. The hospitals and doctors that can give these services are mostly in cities, and people in villages have to travel far, spend a lot of money, and wait a long time to get the help they need. This causes big problems, like delays in knowing what sickness they have and higher costs for healthcare. Teleradiology can help with these problems because it uses the internet to send medical pictures to doctors in cities, so the people in villages don't have to travel far. But for teleradiology to work, we need to know how much people in the village know about it, what they think about it, and why they may not want to use it.

Objectives: This study was done to see how much people in three villages in Ghaziabad, Uttar Pradesh, know about teleradiology and what they think are the good and bad things about it. We wanted to know if people in the village understand teleradiology, and if they think it can help them save time and money by reducing travel, get help from doctors faster, and get better care. We also wanted to see if they are ready to use teleradiology, by asking if they trust the technology, believe it will work well, and if they think it will be easy and cheap for them to use.

Methods: We asked people in the village's questions both online and in person, with surveys that asked about their age, gender, education, and healthcare experiences. We also asked what they know about teleradiology and how they feel about using it. After that, we looked at their answers to see the patterns and trends.

Results: In this study, we have total number of **402** Participants and our survey showed that only 51% of the people had heard of the word "Teleradiology," and out of them, only 3.2% could explain what it means correctly. Even though most people didn't fully understand it, about half (49.3%) thought teleradiology could help healthcare in their village. They believed it could save time by reducing travel (30.1%), give more accurate diagnoses (25.9%), and lower costs (23.1%). But still, many people (50.2%) didn't want to use teleradiology. They were mostly worried about the safety of their data (24.6%), if the technology will work well (26.4%), and not being able to talk to doctors face-to-face (24.1%).

Conclusion: Our study shows that while some people, especially younger people who use the internet, know about teleradiology, many people in the villages still do not know enough. To make teleradiology work in these villages, we need to help people who belongs to rural area by running campaigns about Teleradiology and show them how to use the Teleradiology, make sure the system is easy to use and safe for their personal information, and show them how teleradiology can really help them with their health.

Keywords: Teleradiology, Telemedicine, Rural Healthcare, Healthcare Access, Digital Divide, Awareness, Knowledge, India, Ghaziabad, Uttar Pradesh.

CHAPTER - 1

INTRODUCTION

1.1 TELE-RADIOLOGY OVERVIEW

The combination of technology and medicine has created a new method of providing medical care known as Telemedicine which has the potential of increasing access to medical services in areas that have limited access to medical facilities. Telemedicine is the next step of healthcare in the digital environment [1]. Telemedicine is defined as 'the delivery of health care and sharing of medical knowledge over a distance using telecommunication systems [10]. Future hospitals will be able to attract patients from around the globe without any restrictions. It will become possible to take care of the patient from distant treatment centers [3].

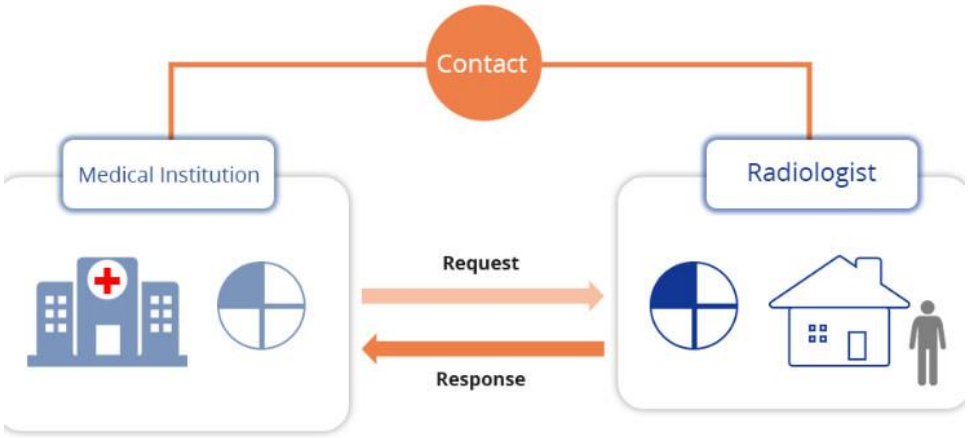


Figure 1.1 Teleradiology Workflow (Medical Institution to Radiologist)

The Indian healthcare system which was established to ensure that every citizen of India has equal and timely access to healthcare services has certain gaps while implementing healthcare services in urban and rural areas. A large number of Indians, some 63.4% (as of 2024) of the Indian

[1] Chellaiyan, VinothG, Ay Nirupama, and Neha Taneja. "Telemedicine in India: Where Do We Stand?" Journal of Family Medicine and Primary Care 8, no. 6 (2019): 1872.

population live in rural areas and depend on public health facilities for their healthcare needs [2], It shows that the situation of the healthcare centres in rural India is much worse than those in metropolitan cities due to the absence of advanced diagnostic techniques that may help in the early diagnosis of such diseases, especially in the field of radiology. An illustration of how teleradiology can close this gap is illustrated below in the diagram below (Figure 1.1).

This is especially so in diagnostic facilities such as radiology that are useful in identifying diseases, making proper diagnoses and starting the right treatment. Unfortunately, the present state of health care systems does not allow for total medical care in rural setup [3].

1.2 The Rural Healthcare Landscape

This basically implies that there is a shortage of well-trained healthcare professionals including the radiologists within rural regions in India, which is a problem in the health sector there. India needs 20,000 radiologists to reach every part of India and at present, there are only 10,000 radiologists [4].

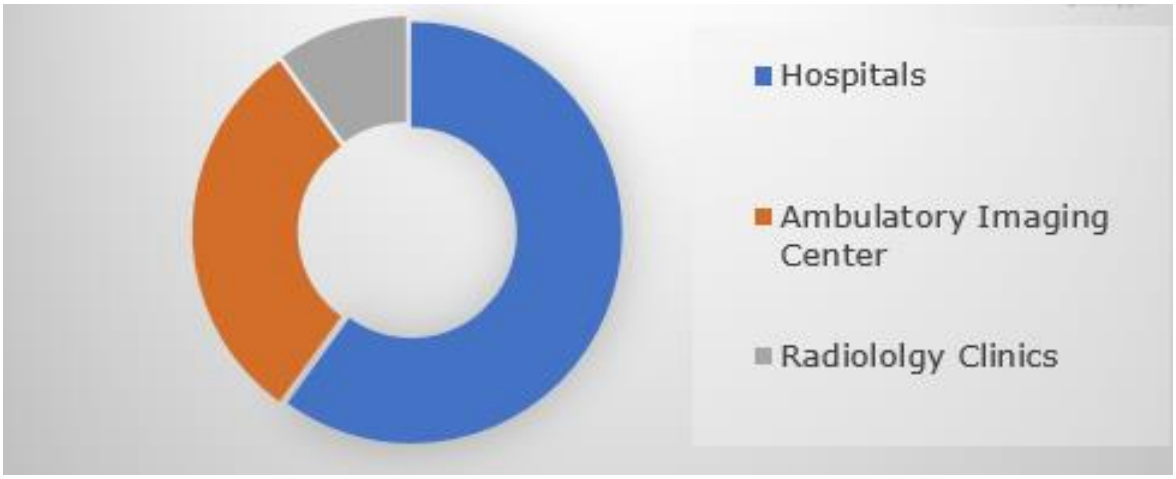


Figure 1.2 India Orthopaedic Devices Market, By End User, Market Share (%) 2030

[2] Kalyanpur, Arjun, Harish T S Nair, and Neetika Mathur. "Teleradiology Service Is Indispensable in the Indian Healthcare Sector." International Journal of Health Technology and Innovation 2, no. 02 (August 17, 2023): 24–27.
[3] Kumar, Sajeesh. "Introduction to Teleradiology." In Teleradiology, edited by Sajeesh Kumar and Elizabeth A. Krupinski, 1–9. Berlin, Heidelberg: Springer Berlin Heidelberg, 2008.
[4] Chidambra Makker, Divey Kapoor, and Surbhi Chaturvedi. "Teleradiology enroute to future growth of india Ijariie16779.Pdf," 2018.

There is also a lack of amenities such as good quality MRI, CT scan, etc. in India; India has only 600 MRI and 50,000 to 55,000 CT scan machines [4]. According to a market analysis, hospitals dominate the healthcare services in India, followed by ambulatory imaging centers and radiology clinics. The limited presence of radiology clinics in rural areas or in total significantly hinders timely diagnoses and treatment (Figure 1.2).

The author stated that: In India, 80% of the population lives in the rural areas while 80% of the doctors practice in the urban areas [5]. As we can also see that in the above figure.

This means that there are few diagnostic centers and radiologists available in the rural area and this is a problem for people's health. Because of scarcity of radiologists, people have to move around, lose their daily wage and they get delayed in their diagnosis; therefore, they remain ignorant of their health status and there is an increase in the disease burden which in turn increases the out-of-pocket expenditure [4]. This is because many patients receive their diagnosis late, thus the disease progresses, the patient's suffering increases and the costs of treatment rise. Lack of diagnostic services in time becomes a big issue for the clinicians especially during emergencies and at night [6]. The cost of seeking medical care in the urban centers which are far away from rural areas compounds the problems of rural communities. The future hospitals can take patients from all over the world without regard to geographical constraints; it is possible to deliver quality medical services to the patient rather than moving the patient to distant and expensive tertiary-care centres [3].

1.3 The Crucial Role of Radiology

Imaging is one of the most important tools in modern medicine since it allows visualizing the internal organs and tissues and help in the identification and treatment of numerous disorders. Radiology is considered to be an essential part of health informatics and epidemiological research

[5] Char, Amit, Arjun Kalyanpur, V N Puttanna Gowda, Anjan Bharathi, and Jasbir Singh. "Teleradiology in an Inaccessible Area of Northern India." Journal of Telemedicine and Telecare 16, no. 3 (April 2010): 110–13.
[6] Burute, Nishigandha, and Bhavin Jankharia. "Teleradiology: The Indian Perspective." Indian Journal of Radiology and Imaging 19, no. 01 (January 2009): 16–18.

and its importance has been a topic of discussion for a long time [7]. From the basic x-ray to the more sophisticated scans like CT and MRI, radiology gives the doctors valuable information to let them to diagnose, manage and follow up patients' conditions. The first clinical images in digital format became available with the advent of CT in the 1980s, allowing the first time to transfer data from one place to another, initially for seeking specialist neuroradiological opinion [8].

Especially in emergency departments, proper and fast interpretation of radiological images is vital because it let the correct diagnosis required for the patients' management. The main value added that teleradiology has brought in the USA and the most that it can offer in India is in the emergency setting [9].Teleradiology has greatly helped emergency care in the USA, and it can offer the most benefits in emergency situations in India too. Thus, teleradiology including telenuclear medicine can be considered as the most clearly defined telemedicine service [10].

1.4 Ghaziabad, Uttar Pradesh: A Case for Study

Ghaziabad in Uttar Pradesh provides a good example for the knowledge and awareness about teleradiology in the rural Indian setting. Teleradiology is the best solution for a country like India when there is no expertise in specialized investigations like CT and MRI particularly in rural areas[11]. The district is both urban and rural and thus shares the common challenges of rural health care including shortage of trained health care Staff, limited diagnostic facilities. The opportunities to include a radiologist in the remote area and the opportunities to divide the workloads of radiologists in undersupplied departments and more supplied ones were also apparent at once [12]. The findings of this study will help in identifying how best to facilitate the implementation of teleradiology in the healthcare delivery system in the rural areas with a view to improving the

[7] Ashcroft, R E, and P R Goddard. "Ethical Issues in Teleradiology." The British Journal of Radiology 73, no. 870 (June 1, 2000): 578–82.
[8] Jarvis, L., and B. Stanberry. "Teleradiology: Threat or Opportunity?" Clinical Radiology 60, no. 8 (August 2005): 840–45.
[9] Kalyanpur, Arjun, and Srikrishna Seshadri. "Teleradiology in India - Utilisation, Benefits and Challenges." International Journal of Telemedicine and Clinical Practices 1, no. 3 (2016): 209.
[10] Thrall, James H., and Giles Boland. "Telemedicine in Practice." Seminars in Nuclear Medicine 28, no. 2 (April 1998): 145–57.
[11] Jankharia, Bhavin. "Current Status and History of Teleradiology in India." International Journal of Medical Informatics 61, no. 2–3 (May 2001): 163–66.
[12] Kuduvalli, Gopinath R., Rangaraj M. Rangayyan, and J. E. Leo Desautels. "High-Resolution Digital Teleradiology: A Perspective." Journal of Digital Imaging 4, no. 4 (November 1991): 251–61.

health of the people. All these technologies, therefore, make teleradiology in India ready to take off because the need for this technology already exists [11].

1.5 Telemedicine: The Foundation:

Telemedicine is a way of practice that enable communication between the health care givers and the patients who are not physically in the same location. It depends on the transfer of medical information such as patient information and clinical details and in the case of teleradiology medical images for making diagnoses and treatment plans and follow up. Telemedicine is a system of health care delivery where the patient and the physician can be in different locations at the time of consultation [3].

The fundamental workings of telemedicine involve:

- **Data Acquisition**: Obtaining necessary patient information in the form of medical data which may involve taking of the patient's temperature, blood pressure through the use of special medical imaging devices, and even retrieving of the patient's electronic health records.
- **Data Digitization**: Converting the obtained information into a form that can be sent across electronic networks in digital form including the use of scanners, digital cameras, specific software or direct digital interfaces of medical equipment. While any medical image can be sent by teleradiology, all images must be digitized for transmission. Hard copy films from any modality can be converted into digital format by high-resolution laser scanners or charge-coupled device (CCD) scanners [10].
- **Data Transmission**: The digitized data should be transmitted over the communication network while applying encryption and security measures to protect the patient's information. In the past, transfer of images was done over telephone lines using modems with transfer rates as low as 2. 4 Kbps. Today, high-speed lines are available and different centres can link directly or through the internet to transfer images [3]. Transmission media can be circuit-switched network or wireless transmission.
- **Data Interpretation**: The data is received at another location such as a doctor's practice or a healthcare center where it is captured, displayed and analyzed by healthcare professionals. The perfect teleradiology sending station should have high resolution, no or

little compression, and high transmission speeds [3]. Image review is done on a workstation that can support the display of high-resolution images. There are many software applications available in the market for instance EFilm through which images can be viewed, manipulated, measured, reconstructed into three dimensions and so on [3].

1.6 Teleradiology: A Specialized Application

Teleradiology can be defined as the transmission of images through telecommunication links with a purpose of interpretation of images like X-rays, CT scans, MRIs and Ultrasounds. There is an urgent need for teleradiology services in India and from the market properties and trends projected; there has been impressive growth in the market with projections of further growth through the decade (Figure 1.3).

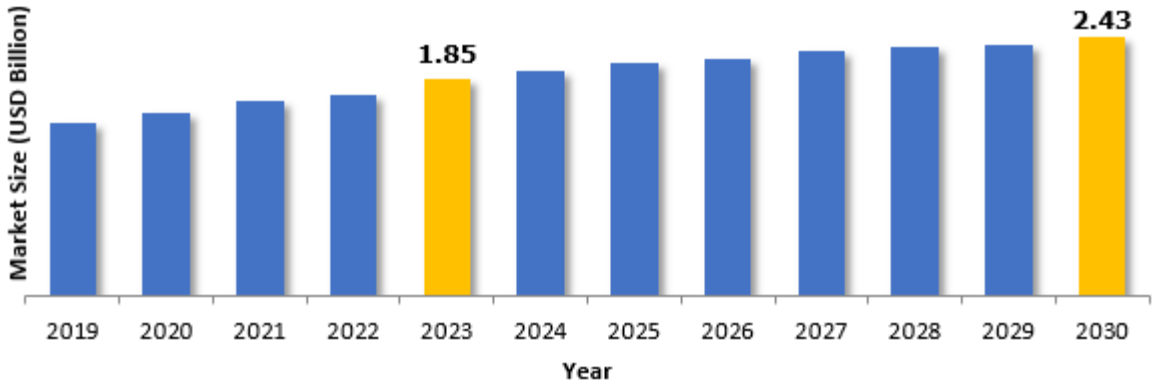


Figure 1.3 India Teleradiology Market Size, By Value (USD Billion) 2019-2023

This Figure 1.3 [13] shows how hospitals use teleradiology to enhance the delivery of health care in rural areas. It also helps the healthcare providers in the regions where there is scarce availability of the specialist radiologists to get the interpretation in a timely and effective manner. The most frequent use of telemedicine is in teleradiology and the other areas include cardiology, dermatology, psychiatry, emergency medicine, home health, pathology, and oncology [10].

[13] https://www.blueweaveconsulting.com/report/india-teleradiology-market

The workings of teleradiology w.r.t telemedicine but with a specific focus on medical imaging:
Image Collection: Images are obtained by utilizing digital radiography or by scanning conventional film radiography.

- **Image Digitization**: The obtained images are then transferred into a digital format most commonly the DICOM format. According to the DICOM (Digital Imaging and Communications in Medicine) standard is used for exchanging image data between an imaging modality and the diagnostic workstation [14].
- **Image Compression**: The images can be compressed by using several techniques to reduce size and enable quicker transfer. The sizes of the typical digitized medical images are large Therefore, transmission of such requires high bandwidth so to decrease the amount of digital data to be transmitted, it can be compressed before transmission [10].
- **Image Interpretation**: Images that are sent are accessed at another station that contains software that enables the viewer to analyze, modify, and interpret images of radiological nature. The American College of Radiology has outlined guidelines for teleradiology; among the guidelines are the need to use high resolution 2000 × 2000 pixel workstations for the interpretation of plain films [10]. The radiologist analyzes the images, forms a diagnosis, and sends a report back to the referring healthcare provider.

1.7 The Role of PACS Systems in Teleradiology

PACS (**Picture Archiving & Communication System**) are very useful in the management of teleradiology processes and work flows. PACS is a computer network system which enables the capturing, storage, retrieval, transmission and presentation of digital images used in medicine.

It is difficult to determine the exact figure but there are over several thousands of teleradiology systems implements in the United States where many of them are what can be described as 'Lower end' or entry level systems that are used by radiologists and nuclear medicine physicians in order to offer backup or on-call services for their practices [10].

[14] Kinosada, Y, A Takada, and M Hosoba. "Real-Time Radiology — New Concepts for Teleradiology." Computer Methods and Programs in Biomedicine 66, no. 1 (July 2001): 47–54.

It does away with the need for physical films, it increases efficiency, decreases on the costs of storage, and allows access to images from a distance.

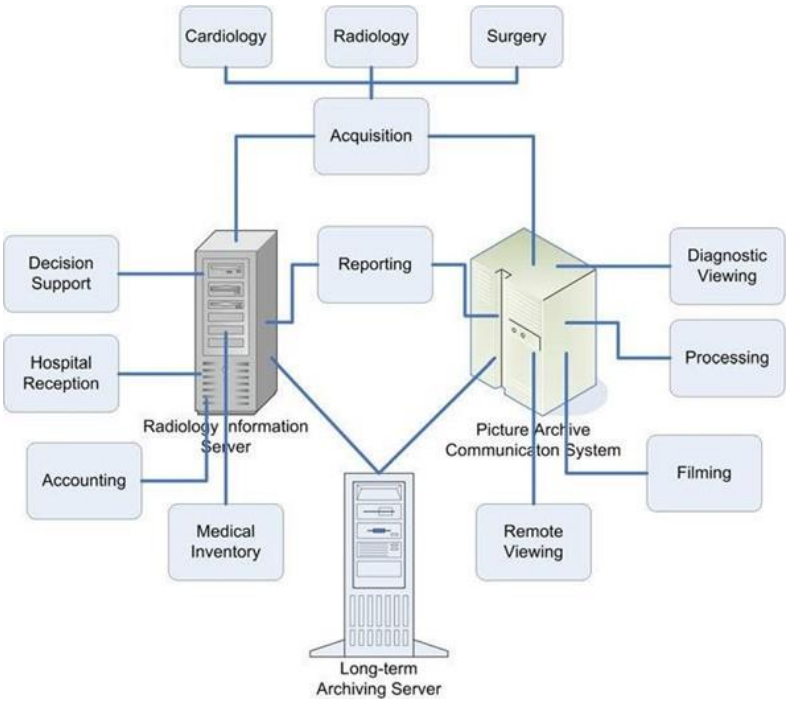


Figure 1.4 Workflow of PACS (Picture Archiving & Communication System)

In the context of teleradiology, PACS enables: In the context of teleradiology, PACS enables: Seamless Image Transfer: PACS systems help in moving images from the acquisition site to the teleradiologist's working station using DICOM protocol.

- **Centralized Image Storage**: This is because PACS provides for retrieval of images from a central archive thus allowing only authorized personnel to access them from any location with network connection. It is possible to find a number of current commercial systems that are close to meeting the requirements of high-resolution digital teleradiology. The Film Fax teleradiology system from Discovery Systems Inc uses a laser film scanner with the resolution of 2,481 × 2,048 × 12-bit pixels and transmission over telephone lines to a receiving terminal with a laser film recorder and a high-resolution display monitor with 2,048 pixels/scanline [12].

- **Remote Image Viewing**: The teleradiologists can work with the images by using the PACS workstations and give their opinion as to whether the images are original or not even if they are not in the same location as where the images were taken. This multimedia diagnostic workstation was based on a commercially available engineering workstation INDIGO2 (Silicon Graphics, Inc.: For example, the workstation used is INDY (Silicon Graphics, Inc. : CPU, R4400-250 MHz; SPECint92, 176; SPECfp92, 165; memory, 192 MB; Hard Disk, 4 GB) or INDY (Silicon Graphics, Inc. : CPU, R5000-180 MHz; SPECint95, 4. 1; SPECfp95, 4. 4, memory, 64 MB, Hard Disk, 3 GB) [14].

PACS helps the radiologists and clinicians and other healthcare givers to share images, discuss and consult on them as and when necessary.

1.8 Importance of this Study

Though the concept of teleradiology has been identified to have the potential of revolutionising the provision of health care services in rural India, the actual implementation cannot be done without understanding the current knowledge, attitudes and practices regarding teleradiology in the proposed context, Telemedicine, including teleradiology, is here to stay and will change the practice of medicine in ways that we can only begin to envision today [10]. The present research in the selected rural area of Ghaziabad aims at evaluating the awareness level of teleradiology so as to develop suitable strategies for implementing this system in the health facilities. The problem is how to integrate efficient and secure means of image and radiology report transfer for rural communities [5].

1.9 Addressing the Knowledge Gap

Although there is increasing literature on telemedicine in India, the awareness and understanding of teleradiology among healthcare personnel and the society especially in rural India have not been well studied [6]. Despite the availability of reasonable and reliable connections, the cost of transferring images has been a major challenge [11]. This knowledge gap can hinder teleradiology's effectiveness. It is important to assess awareness among healthcare practitioners in rural Ghaziabad. Physicians including radiologists are usually computer illiterate even though they work

with high-level computers [11]. Teleradiology in a fully implemented model in a hospital with or without multiple sites, point to point (hospital to the radiologist's home), in the regional hospital networks (for instance Scandinavia and Spain) [15]. The community's readiness to embrace teleradiology depends on factors such as confidence in technology, fear of data violation, and costs. There is also a 'third-world' status and credibility issue: The medical practice in India has grown extensively and the Indian radiologists are fairly competent, but the Western patients are not willing to have their scans interpreted by Indian radiologists if the scans were done in India [6].

1.10 Identifying Challenges and Solutions

This research will also establish the pros-cons of teleradiology in rural Ghaziabad among them being; easy access to specialized professionals, speedy diagnosis, and no frequent trips to the clinical center. Among the measures that were undertaken by the government of the United Kingdom between the years 2001 and 2003 in its effort to establish shorter waiting lists for the NHS, the process has now been extended to include radiology and there is the likelihood of private companies in the UK to bid for outsourcing diagnostic imaging off site from the hospital trusts [8]. The advantages of teleradiology have been presented and are as follows Decentralized examination in loaded radiology departments could be helpful in reducing the time that patients spend waiting to be attended and cheaper overseas reporting may be financially sustainable though the matters of care should also be considered [8].

Other variables that must be highlighted include impediments that are physical, technological, financial or social. From the above factors, the challenge includes; Ineffective and limited telecommunication infrastructure, Radiologists, and physicians' lack of understanding and resistance towards teleradiology methods and use of computers and High charges by vendors for teleradiology software [11].

[15] Barneveld Binkhuysen, F.H., and E.R. Ranschaert. "Teleradiology: Evolution and Concepts." European Journal of Radiology 78, no. 2 (May 2011): 205–9.

1.11 Developing Plans for Successful Implementation

This research will reveal the gaps in knowledge, barriers in teleradiology knowledge and practice, and enablers that need to be exploited for enhancing teleradiology knowledge and practice in the rural area of Ghaziabad. Some of the factors that have been found to hinder the development of teleradiology in the country include; Cost Quality [6]. The smallest variation between the radiologist's report and the clinical physicians at Mena was noted regardless of the radiologist and the technique deployed to analyze the films [16].

It is usually a set of prevention and control measures that may involve education of the healthcare workers, community health initiatives, policy advocacy as well as sourcing for funds. "FULL COMMITMENT" by all parties involved in this study of data protection and patient confidentiality The scheduling of regular teleconferencing in place of clinicoradiological meetings [7]. This research sets out the following objectives to find gaps and barriers to improve teleradiology and thus improve healthcare in rural Ghaziabad.

[16] Franken, E A, P Whitten, and W L Smith. "Teleradiology Services for a Rural Hospital: A Case Study." Journal of Telemedicine and Telecare 2, no. 3 (September 1, 1996): 155–60.

NEED FOR STUDY

In this study we are trying to understand if a new technology called "**Teleradiology**" could help in rural areas in Ghaziabad, U.P. We wanted to find out if people in villages know about teleradiology, what they think about it, and if they would be willing to use it. If teleradiology works well, it could make healthcare much easier for people in villages.

In India, it is very hard for people in villages to get special healthcare, like radiology services. Most of the hospitals and doctors are in cities, and the people in villages do not have enough help. Because of this, people in rural areas often get sick and do not get proper treatment or tests on time, which makes their health worse.

But these important services are far away in city hospitals, so people in villages have to travel long distances to get them. This travel costs a lot of money, takes up a lot of time, and causes problems in their daily life.

CHAPTER - 2

AIM AND OBJECTIVES

AIM:

Evaluation of Knowledge and Awareness about Tele-Radiology in Rural Areas of Ghaziabad, U.P., India

OBJECTIVE:

1. To assess the knowledge about teleradiology in rural areas of Ghaziabad
2. To evaluate the awareness about teleradiology in rural area of Ghaziabad.
3. To determine the services and benefits of teleradiology.

CHAPTER - 3

REVIEW OF LITERATURE

3.1 Kuduvalli, Gopinath R., Rangaraj M. Rangayyan, and J. E. Leo Desautels. "High-Resolution Digital Teleradiology: A Perspective." Journal of Digital Imaging 4, no. 4 (November 1991): 251–61.

This paper aims at providing a background of teleradiology from the analog teleradiology to the present digital teleradiology. The authors emphasize that the use of high-resolution digital teleradiology is crucial in order to enhance diagnostic imagery of images that are used in the management of patient care including chest X-rays and mammogram. As for the spatial resolution it is indicated that it should be no less than 4096×4096 pixels with the gray scale of at least 1024 to provide the same amount of information as in the case of film-screen radiography. However, these high resolutions also create some problem with the data transmission and storage as well. The paper identifies data compression as a possible solution to these challenges with a realization that lossless compression can compress the data by a factor of 4:1 without affecting the image quality. According to the authors' expectations, the future teleradiology terminals will have integrated image analysis and compression systems.

Relevance to this thesis: Hence, this paper is important as it outlines the developments that have been made in technology in order to support high resolution digital teleradiology. It is even more important in the rural areas of India where the bandwidth of internet connection is not as good as in the cities. Knowing the factors that led to the creation of teleradiology and the problems solved by it opens up the discussion for teleradiology in rural Ghaziabad.

3.2 Franken, E A, P Whitten, and W L Smith. "Teleradiology Services for a Rural Hospital: A Case Study." Journal of Telemedicine and Telecare 2, no. 3 (September 1, 1996): 155–60.

This paper aims at provide analysing the level of satisfaction of the teleradiology services provided to a rural hospital to that of other modes of radiology service delivery. Data was collected through the administration of questionnaires by the researchers to the administrators, technologists and physicians at the rural hospital and then a survey of all the staff physicians. The study revealed that teleradiology was considered to be as accurate as the traditional on-site film interpretation but there were questions on other elements of the service. These service-related issues have been discussed in this study to highlight the need to give attention to them so that teleradiology can be seen as a useful and effective service for rural hospitals.

Relevance to this thesis: Hence, this paper is important as it outlines issues that go beyond diagnostic accuracy to assess the effectiveness of teleradiology services in rural areas. The results suggest that further research should be conducted in order to determine the attitudes of the healthcare professionals and the patients towards the quality, effectiveness, and communication structures of teleradiology in rural Ghaziabad.

3.3 Davis, Mark C. "Teleradiology in Rural Imaging Centres." Journal of Telemedicine and Telecare 3, no. 3 (September 1, 1997): 146–53.

This paper aims at providing the economic implication of implementing teleradiology to a private commercial magnetic resonance (MR) imaging service in a rural area is discussed. Cost analysis of the conventional film-based MR service has been compared with the filmless digital MR service through teleradiology by the author of the study. The study revealed that the mid-field MR unit with teleradiology is able to achieve a cost of $470 per case as opposed to the film-based service with the use of a courier which is $544 per case. The author then goes on and describe a two-year pilot study of teleradiology for MR imaging where over 8000 examinations were sent without compression over the ISDN at 128 kbit/s. This study found that for a normal case, it took 6-8 minutes; the preliminary conclusion could be made within 2 hours while the final report was sent electronically within 24 hours. Upon comparing the results of the surveys with the initial hypothesis it was seen that the referring physicians as well as the patients were happy with the teleradiology service.

Relevance to this thesis: Hence, this paper is important as it outlines the opportunity of teleradiology to enhance the delivery of speciality imaging services to remote locations. This work also shows that teleradiology can be used to offer MR imaging in a timely manner in rural Ghaziabad with the aim of improving the situation for the patients and the health care systems.

3.4 Yawn, Barbara, Sarah Krein, Jon Christianson, David Hartley, and Ira Moscovice. "Rural Radiology: Who Is Producing Images and Who Is Reading Them?" The Journal of Rural Health 13, no. 2 (March 1997): 136–44.

This paper aims at providing the current status and patterns of imaging and interpretation services in reinforced rural hospitals in North Western America. Data on the use of imaging equipment and on-site radiologists in 1991 and 1994 were collected through telephone interviews with rural hospital administrators in eight states. Consequently, the availability of MRI, CT, ultrasound, and mammography equipment was determined to have improved between 1991 and 1994 with MRI, especially in mobiles. However, the accessibility of on-site radiologists was still very limited, in that, only 18% of the hospitals offered daily radiology services in 1994. The study reveals the fact that hi-tech service such as teleradiology are being adopted widely in rural hospitals to offer interpretation services.

Relevance to this thesis: Hence, this paper is important as it outlines the trends of the advances in imaging technology and the availability of radiologists in the rural regions of the US are similar to those of India. The study highlights the possible application of teleradiology in closing the gap of specialist practice and timely image reporting especially in decentralised areas such as Ghaziabad.

3.5 Thrall, James H., and Giles Boland. "Telemedicine in Practice." Seminars in Nuclear Medicine 28, no. 2 (April 1998): 145–57.

This paper aims to provide an insight into the definition of telemedicine, its evolution, its uses in clinical practices and the development that has made it to take root. The authors also note that telemedicine evolved in the 1990s due to the advancement of digital medical equipment, and high-speed communication technology. They describe different types of clinical applications of telemedicine such as teleradiology, telecardiology, teledermatology, telepsychiatry and telesurgery with the observation that teleradiology is the most prevalent and well-understood telemedicine service. The authors describe the practical considerations of teleradiology including imaging, compression and transmission, interpretation of images and refer to the ACR guidelines to promote quality teleradiology. They also focus on some emerging questions in telemedicine such as licensure, standards for practice, reimbursement, privacy and confidentiality of patients, and telecommunication systems as well as costs.

Relevance to this thesis: Hence, this paper is important as it outlines a general view of telemedicine and teleradiology in the overall healthcare system. The identification of the technical features, uses and concerns of telemedicine forms a useful guide for assessing the opportunities and concerns of using teleradiology in rural Ghaziabad.

3.6 Ashcroft, R E, and P R Goddard. "Ethical Issues in Teleradiology." The British Journal of Radiology 73, no. 870 (June 1, 2000): 578–82.

This paper aims at providing the ethical issues concerning teleradiology recognizing the risks that are linked to confidentiality, data security, consent, competence, interprofessional relationships as well as the structure of medical services. The authors stress the concept that although the application of teleradiology has the probabilities that it can be useful for defining better access to expertise and the better utilization of resources but at the same time this is an area that has numerous ethical issues which need to be discussed and analyzed. They consider the best data protection mechanisms that can be adopted to protect the identity of the patient and the privacy of their data especially when it is in the electronic format. They also highlight the need to oversee competence in each of the ends of teleradiology, thereby ensuring that physicians who are on the requesting and providing ends are competent enough. We derive recommendations as to the minimum ethical and professional competencies for teleradiology practice that are outlined in the paper about the relations between users and providers, returns, and quality assurance as well as compliance with the international data protection laws and conventions.

Relevance to this thesis: Hence, this paper is important as it outlines the aspects of ethics which are barely possible to disregard when it comes to teleradiology. The issues of confidentiality, security of data, competence and interprofessional relations are crucial to elucidate the prospects and limitations of the teleradiology service delivery in rural Ghaziabad along with providing the best possible ethical framework.

3.7 Jankharia, Bhavin. "Current Status and History of Teleradiology in India." International Journal of Medical Informatics 61, no. 2–3 (May 2001): 163–66.

This paper aims at provide the historical background and the current state of teleradiology in India. The author contends that despite the fact that teleradiology is the most suitable technology for India given the absence of specialists in remote areas to interpret complex exams such as CT and MRI scans, the technology has not grown due to a number of factors. These are poor telecommunications infrastructure especially in the rural areas; lack of knowledge and appreciation of the teleradiology methods and computer technology by the radiologists and physicians; and exorbitant prices charged by vendors of teleradiology packages. The author narrates his own experience as a pioneer in the use of teleradiology in India beginning with a basic teleradiology system in 1996 to transfer images from his center to homes to report on emergency CT scans. He emphasises on the fact that the teleradiology solutions should be affordable and feasible in the Indian scenario.

Relevance to this thesis: Hence, this paper is important as it outlines the peculiarities of the Indian context and the problems and prospects of teleradiology in this country. The author's experience in teleradiology practice also show that to overcome barriers to adoption in rural areas such as Ghaziabad, there is a need to seek for low-cost solutions and proper training.

3.8 Kinosada, Y, A Takada, and M Hosoba. "Real-Time Radiology — New Concepts for Teleradiology." Computer Methods and Programs in Biomedicine 66, no. 1 (July 2001): 47–54.

This paper aims at providing Real-time radiology and Seamless operation as new paradigms in teleradiology. The authors present a system that has been designed for cooperative diagnosis which involves the exchange of radiographic images in real time during audio-visual communication. The system is based on a multimedia diagnostic workstation which enables the radiologist to shift from the traditional film reading mode to the real time teleradiology mode to interact with other radiologists and technologists at the remote sites. The authors present the clinical practice using the system and provide conclusions on the potential to increase the diagnostic effectiveness of teleradiology through the system. They posit that real time radiology may change the teleconsultation and telepresence and thus has the potential of improving collaboration and communication in radiology.

Relevance to this thesis: Hence, this paper is important as it outlines the ideas in teleradiology are presented which may be useful in enhancing the quality of service in places like Ghaziabad where direct consultation with the specialists could be very useful. Teleradiology systems' automated and cooperative control demonstrate how the discipline can avoid limitations related to distance and appear to have a lot of potential for improving the collaboration of healthcare professionals.

3.9 Struber, J., and J. Tichon. "Minimum Technical Requirements and Evaluating Effectiveness of Teleradiology." Technology and Health Care 11, no. 6 (December 1, 2003): 391–98.

This paper aims at providing the minimum technical requirements that are required for delivering good teleradiology services and the challenges of evaluating the value of these services. The authors present many aspects of the teleradiology systems including image acquisition and display, network bandwidth, latency, ubiquitousness, accessibility and organisational effects. They emphasize on the quality of image, transmission and user-friendly workstations to improve diagnostic information and acceptability of teleradiology. The authors also give some information on the kind of service evaluation that can be done such as user satisfaction, clinical and cost-effectiveness; the authors note that it is challenging to put a value on teleradiology since it is a form of service that is still relatively new. It also concludes by stressing the necessity of further detailed and planned research to guide subsequent policies, and resources and to ensure that all have an equal chance of accessing quality teleradiology services.

Relevance to this thesis: Hence, this paper is important as it outlines the technical principles and impediments to research in the field of teleradiology in a single article. The aspects of user satisfaction, clinical outcomes and costs are crucial for the assessment of teleradiology effectiveness in rural Ghaziabad where the lack of resources and accessibility of medical care are the problems of the present day.

3.10 Jarvis, L., and B. Stanberry. "Teleradiology: Threat or Opportunity?" Clinical Radiology 60, no. 8 (August 2005): 840–45.

This paper aims at providing the prospects of teleradiology as a threat to and as a potential for the practice of radiology. To their admission, the authors demonstrate how demand for teleradiology is being increasingly used to overcome radiologist shortages and shorten waiting lists; the UK is a prime example where overseas reporting services are increasingly being used. They talk about the benefits of teleradiology including increased opportunities for experts' consultation, elimination of waits for medical consultation and perhaps more cost effective. But they also have inherent concerns with regard to clinical governance, and ethics and with the potential for deterioration of the quality of the services. Particularly, the article strongly insists on the definition of clear guidelines, the existence of proper and effective quality assurance and assurance mechanisms that should be considered within the scope of the medico-legal approach to teleradiology so that it should enhance but should not worsen the existing best practices of radiology.

Relevance to this thesis: Hence, this paper is important as it outlines the possible pros and cons of this technique so that a proper middle ground that allows for the adoption of teleradiology will be established. The discussion of clinical governance, ethical issues along quality assurance is of great significance while developing the effective and rightful strategies to implement the teleradiology in rural Ghaziabad.

3.11 Kumar, Sajeesh. "Introduction to Teleradiology." In Teleradiology, edited by Sajeesh Kumar and Elizabeth A. Krupinski, 1–9. Berlin, Heidelberg: Springer Berlin Heidelberg, 2008.

This paper aims at providing teleradiology, defining it, explaining how it works as well as where it is used. The author emphasized on the fact that teleradiology is among the sub-set of telemedicine which is a practice whereby the use of telecommunication technology is employed in transmitting radiological images from one location to another for analysis or consultation. This article presents general information concerning the teleradiology system with special emphasis on the image sending station, image transmission path, receiving and image reviewing station. It also provides information under technical aspects of image resolution, companion image techniques and modem speed as functions about image transfer. Some of the practice areas of teleradiology that the author mentions include on call teleradiology, consultative radiology for primary care physicians teleradiology and referral consultative subspecialty teleradiology. In the conclusion, the authors talk about the usage of teleradiology in the developing countries where this approach can clear the lack of radiologists and provide population with the qualified diagnostic services.

Relevance to this thesis: Hence, this paper is important as it outlines the basic information about what teleradiology is and its key components which are crucial while considering the stunning use of teleradiology in the rural area of Ghaziabad. The elaboration of technicalities and adaptability of a generalization of the concept of teleradiology in the context of developing countries provides a firm understanding of what may be present, active or in the process of formation in the scenario of India.

3.12 Burute, Nishigandha, and Bhavin Jankharia. "Teleradiology: The Indian Perspective." Indian Journal of Radiology and Imaging 19, no. 01 (January 2009): 16–18.

This paper aims at providing the teleradiology from the Indian context and examines the possibilities it may offer, the take-up rate, and the problems which prevent a global usage of the concept. The authors stress the requirement for development the teleradiology in India especially in rural regions due to lack of the qualified radiologists. They indicate how this shortage can be solved by teleradiology, which allows subspecialty interpretations, emergency and night time coverage of radiologists, and enhancement of radiology services. The article also provides for a discussion on the history of teleradiology in India, the evolution from early attempts, to dedicated teleradiology organizations. The authors look at some issues that have made the teleradiology industry in India struggle, these include cost, quality, regulation and a small market.

Relevance to this thesis: Hence, this paper is important as it outlines the Indian context of teleradiology mainly focusing on the problems and prospects that are central to this thesis. The concluding part of the paper that analyses the risks includes the cost limitations, quality concerns and the regulatory challenges proves relevant for explaining the problem of lack of teleradiology in rural facilities like Ghaziabad.

3.13 McLean, Thomas R. "Will India Set the Price for Teleradiology?" The International Journal of Medical Robotics and Computer Assisted Surgery 5, no. 2 (June 2009): 178–83.

This paper aims at providing the economic possibility of India becoming a major provider of teleradiology services in the world. Analyzing the author's idea, one must acknowledge that even though Indian teleradiologists have lower prices since labour is cheaper than in other countries, trade is set by comparative advantages. In this article, the author examines the actual potential of India to establish a comparative advantage in teleradiology with the help of Ricardian and Heckscher-Ohlin trade theories. The author believes that sending teleradiology services from India to other countries might reduce the number of radiologists available for patients in India in the future. Further, the unavailability of a sufficiently large number of English-speaking radiologists in India, a factor discovered to be limiting its ability to capture the entire US teleradiology market.

Relevance to this thesis: Hence, this paper is important as it outlines the opportunities that teleradiology offers in the Indian setting. Although the emphasis has been placed on international outsourcing, the explanation of the concept of the freedom of opportunity and the necessity of having or employing English-speaking radiologists applies to the internal logics of the teleradiology market in India and its implications for rural areas such as Ghaziabad.

3.14 Char, Amit, Arjun Kalyanpur, V N Puttanna Gowda, Anjan Bharathi, and Jasbir Singh. "Teleradiology in an Inaccessible Area of Northern India." Journal of Telemedicine and Telecare 16, no. 3 (April 2010): 110–13.

This paper aims at providing an explaination about the teleradiology system which has been developed and installed in a remote and uncommunicated place in Arunachal Pradesh, India. The authors describe the situation of the RKMH which provides services to a population of over a million from the rural area and has limited access to a radiology specialist. Today, the hospital has a CT scanner but it still lacks enough radiologists which forced the hospital to outsource their CT scans to a commercial teleradiology service provider situated in Bangalore more than 3000 kilometres away. This paper defines the technical dimensions of the system where a 256 kbit/s ADSL connection, the sFTP, and RIS are discussed. In the same 12 months, the system was able to send out 962 CT studies with an average of 6 hours lead time for elective cases as well as less than 30 min lead time for emergency cases. Therefore, the authors provide evidence on the practicality and effectiveness of teleradiology for providing good quality radiology services to such regions in India.

Relevance to this thesis: Hence, this paper is important as it outlines how teleradiology was put into practice in a low-resource area in India. The facts about technicality, the problem encountered, and the benefits obtained are significant to this thesis since they prove that teleradiology eliminates localized healthcare shortcomings in rural Ghaziabad.

3.15 Krestin, Gabriel P. "Commoditization in Radiology: Threat or Opportunity?" Radiology 256, no. 2 (August 2010): 338–42.

This paper aims at providing the commoditization process in radiology, they analytically consider the problem of the increasing tendency to see radiological services on the model of standardized products that exclude the professional qualifications of radiologists. Consequently, the author discusses how commoditization, which can be viewed as one of the threats, can, in fact, be an opportunity because it allows radiologists to reinvent themselves and stress on their position as consultants. Concerning the implications of academic articles for the knowledge examined in this course, the article shows that diverse aspects of radiology services development – starting from the schedule to the protocols and imaging interpretation – can be commoditized if standardized and backed up by technological progress. The author opines that radiologists should consider specialism in such matters as clinical consultation, teamwork and innovativeness as a way of avoiding sinking to the level of producing generic services.

Relevance to this thesis: Hence, this paper is important as it outlines the question of the likely consequences of commoditization in influencing the delivery of teleradiology services especially in the rural regions. Appreciation of the push factors that often lead to standardization and erosion of price premiums requires an understanding of unique teleradiology business models that are sustainable and acknowledge the importance of quality and price at the same time.

3.16 Barneveld Binkhuysen, F.H., and E.R. Ranschaert. "Teleradiology: Evolution and Concepts." European Journal of Radiology 78, no. 2 (May 2011): 205–9.

This paper aims at providing how teleradiology has developed over the years and the various uses of teleradiology together with the controversy that surrounds it. , the authors discuss the transition from the use of videotaped images in the early forms of teleradiology compared to the current forms dominated by digital teleradiology due to the development of digital imaging and data compression techniques as well as increased availability of high-speed telecommunication networks. They describe a number of specialities and clinical applications of teleradiology, as currently practiced in emergencies, remote consultations, second opinions, and subspecialty interpretations. The article also documents the various service and business strategies of teleradiology ranging from the after hours teleradiology services to that of commercial diagnostic reading service internationally. The authors stress on the concepts of clinical governance and quality assurance, and also on handling medico-legal implications of teleradiology to ensure patient safety and appropriate practice of teleradiology.

Relevance to this thesis: Hence, this paper is important as it outlines the enormous utility and the changing perception of teleradiology across the sectors, this article is valuable. It points to the fact that except the technical concerns, clinical governance and quality assurance are the areas of focus for the effective and safe implementation of the teleradiology services in rural Ghaziabad.

3.17 Khodaie, Mahdieh, Azam Askari, and Kambiz Bahaadinbeigy. "'Evaluation of a Very Low-Cost and Simple Teleradiology Technique.'" Journal of Digital Imaging 28, no. 3 (June 2015): 295–301.

This paper aims at providing the possibility and effectiveness of a new teleradiology technique involving the ordinary digital camera and image compression. The authors briefly acknowledge some of the challenges likely to face implementation of teleradiology in underdeveloped as well as developing nations inclusive of the traditional application of films plus inadequate bandwidth. The research involved the use of digital camera for capturing images of 70 posteroanterior chest X-rays which were then compressed using a lossy compression technique. Both the conventional and the digital images were interpreted by two radiologists other than the ones who had compressed the radiographs with the examiners' knowing the compression percentages. The analysis of the findings which were compared between the initial radiograph and the non-compressed digital image did not reveal any statistically significant variation in their diagnostic accuracy. In addition, the research revealed that lossy algorithms used at a threshold of 50% or below adversely affected diagnoses and picture quality. The authors justify that such a Teleradiology system that uses a Digital camera and image compression is feasible and cheap for use in low-resource settings.

Relevance to this thesis: Hence, this paper is important as it outlines a feasible and economical teleradiology model which could be more advantageous for the regions of less developed India, especially in the rural zones where high-quality equipment and broadband Internet connection is still a dream. These studies imply that with the use of a basic digital camera and proper image compression, one could establish effective teleradiology services in Ghaziabad.

3.18 Mohan, Chander and SM. "Teleradiology- a Cyber Cafe Approach." Indian Journal of Radiology and Imaging 26, no. 02 (April 2016): 159–60.

This paper aims at providing the contemporary practice of teleradiology with arguments that the practice tends to alienate radiologists from patients and other clinicians. Using the teleradiology centers, the author compares them to 'cyber cafes' where many workers including the radiologists work in isolated cubicles most of the time. The article for instance says that working at a faster pace, working to highly stringent turnaround times and focusing more on the number of images interpreted as opposed to the quality gives a sense of professional dissatisfaction and ''feel isolated'' teleradiologists. The author wishes to bring about change as well for teleradiologists by insisting that they take a more active role in clinical debates, attend multi-disciplinary meetings and retain good working relationships to avoid the adverse effects of alienation and stress.

Relevance to this thesis: Hence, this paper is important as it outlines the potential consequences is this article for the professional experience and satisfaction with the work of radiologists. At the same time, understanding these disadvantages will help to optimize the development of effective teleradiology models that will retain professionals' interests, protect the health and welfare of radiologists, and expand teleradiology services for regions like Ghaziabad.

3.19 Jacobs, Jac J. W. M., Rianne Ekkelboom, Jan P. A. M. Jacobs, Thys Van Der Molen, and Robbert Sanderman. "Patient Satisfaction with a Teleradiology Service in General Practice." BMC Family Practice 17, no. 1 (December 2016): 17.

This paper aims at providing the perception that patients have towards the given teleradiology service being offered in the general practice facility located on Ameland Island. The authors describe the increased long distance of referral for secondary health care and how they believe that moving some diagnostic tools to the primary care could be useful. The study design used in the study was a cross-sectional survey of patients who had X-ray examinations through the teleradiology service and this was conducted using the Dutch Patient Satisfaction Questionnaire III. In this regard, the results of patient satisfaction surveys highlighted that the teleradiology service was satisfactory, especially among the island patients who do not have to travel to study in the mainland hospital. Patients gained satisfaction from the technical competency of the doctor who is rendering the service as well as the communication aspects of the consultation. Though existing research on teleradiology focuses more on its positive effects and impacts, the study emphasises again that teleradiology can enhance patient satisfaction level as it increases access and convenience to radiological services, especially in rural areas.

Relevance to this thesis: Hence, this paper is important as it outlines the patient's experience on the teleradiology services such as the service convenience and accessibility. In a similar vein, the authors submit that the same kind of advantages could be accrued if teleradiology were to be introduced in rural Ghaziabad where the availability of specialist radiologists is badly wanted.

3.20 Kalyanpur, Arjun, and Srikrishna Seshadri. "Teleradiology in India - Utilisation, Benefits and Challenges." International Journal of Telemedicine and Clinical Practices 1, no. 3 (2016): 209.

This paper aims at providing the provision of teleradiology services in India; thus, this article gives us an exhaustive exploration of teleradiology in India. The authors have presented the topics of concern in the area of teleradiology, the utilization patterns and the advantages and disadvantage in Indian scenario. They make a debate on the shortage of radiologists currently being experienced in India and the increasing demand for their service, which teleradiology has the ability to overcome. The article presents the detailed uses of teleradiology in India such as in emergency care, dealing with the backlog in outpatient imaging; availability of subspecialist's reports catering to distant places and screening programmes. The authors point out the main obstacles to the development of teleradiology such as infrastructural constraints, lack of knowledge, insufficient IT facilities, financial issues and picture quality. They conclude that based on these issues, teleradiology could be a revolutionising technology with the potential to change the course of India's health sector greatly.

Relevance to this thesis: Hence, this paper is important as it outlines the contemporary use of teleradiology in India including the utilisation, advantages and disadvantages. It is proven that the author's experience in the field is helpful in putting the issue of teleradiology into proper

perspective, particularly in the Indian context, in addition to offering possible measures to address challenges that hinder the application of teleradiology in rural regions like Ghaziabad.

3.21 Chidambra Makker, Divey Kapoor, and Surbhi Chaturvedi. "TELERADIOLOGY ENROUTE TO FUTURE GROWTH OF INDIA Ijariie16779.Pdf," 2018.

This paper aims at providing the issues of disparities within the health sector especially the remote areas of India. The authors for instance explain that there is a severe shortage of radiologists and the absence of sophisticated imaging equipment in rural India and this has greatly contributed to high travel costs among patients in their bid to access imaging services. The article is a general introduction to teleradiology and examples of Digital Imaging and Communications in Medicine (DICOM) and the adoption of Health Level Seven (HL7). The authors also describe several measures that the Indian government has taken to improve teleradiology with the help of pilot projects in the states of Pauri District Hospital and Narayana Hrudayalaya Hospital. They also underscore the problems experienced in these endeavours. Although the author provided his analysis of teleradiology scenario, he outlined several suggestions for great enhancement in the upcoming future for teleradiology; these include more public-private partnerships, free PACS software, and another thought – improved broadband Internet connection in rural areas.

Relevance to this thesis: Hence, this paper is important as it outlines the practice of teleradiology to the extent of discovering the significance of disseminating benefits and the possible difficulties in teleradiology services in rural settings in India. The information on the government's programs and suggestions for future development are helpful in considering the current policy measures and possible approaches to increase the teleradiology implementation in Ghaziabad.

3.22 Chellaiyan, VinothG, Ay Nirupama, and Neha Taneja. "Telemedicine in India: Where Do We Stand?" Journal of Family Medicine and Primary Care 8, no. 6 (2019): 1872.

This paper aims at providing the current status of telemedicine in India and its primary goal of overcoming healthcare disparities with an emphasis on the rural populations. The authors describe the telemedicine development process tracing back the time from the late 18th century to the contemporary developments and inductions of ICT technologies and internet connection. They define real-time and store-and-forward telemedicine and under what conditions telemedicine can be used in health care practice, education, research, screening and after disaster. This article also analyses the government policies including National Telemedicine Taskforce and the launching of the National Telemedicine Portal to encourage the setting up of telemedicine in India. The authors outline the problems that have influenced telemedicine development: too weak infrastructure, the poor level of doctors' awareness, and the absence of data protection and security means.

Relevance to this thesis: Hence, this paper is important as it outlines a general insight into telemedicine activity in India while explaining government initiatives and prospects which have to be considered to ensure telemedicine success. It is within this context that the hype and reality of teleradiology can be understood as a specialised telemedicine service for enhancing access to healthcare in rural Ghaziabad.

3.23 Agrawal, Anjali. "Emergency Teleradiology-Past, Present, and, Is There a Future?" Frontiers in Radiology 2 (June 24, 2022): 866643.

This paper aims at providing the current status and future of emergency teleradiology, and the issues and potentialities that characterise this developing and promising speciality area. The author focuses on the growth of emergency radiology and reveals that upsurge in imaging volumes and the need in specialized interpretations boost internal and external teleradiology services. Some of the topics covered in the article include the use of teleradiology to deal with radiologist shortage, provision of around the clock service and sub speciality consultancy services especially from experts in particular regions. It also looks at the challenges of emergency teleradiology such as having to produce high quality interpretations in shorter time than usual, the quality assurance measures put in place, the incorporation of AI in emergency teleradiology.

Relevance to this thesis: Hence, this paper is important as it outlines the subject of emergency teleradiology which is one of the most important applications of teleradiology for enhancing access to healthcare in the rural regions. The information concerning the advantages and disadvantages as well as future outlooks is supposed to be useful to assess the possibilities of improving the emergency medical practice with the help of teleradiology in Ghaziabad.

3.24 Kalyanpur, Arjun, Srinivas Meka, Kishor Joshi, Harish Thirumanassril Somashekaran Nair, and Neetika Mathur. "Teleradiology in Tripura: Effectiveness of a Telehealth Model for the Rural Health Sector." International Journal of Health Technology and Innovation 1, no. 02 (August 17, 2022): 7–12.

This paper aims at providing on how one can implement a successful teleradiology service in Tripura which is one of the states in the northeast India with the majority of its population living in rural areas and does not have easy access to the radiologists. The authors explicate a case of Teleradiology Solutions based in Bangalore supporting 26 Community Healthcare Centers (CHCs), District Hospitals (DH), and Sub-district ICU (SDH) hospitals in Tripura, located more than 3000 km away. It included capturing the analog X-ray images with a digital camera, formatting the captured images as DICOM and uploading them on a web-based RIS-PACS software for a report from expert radiologists in Bangalore. In total 78,622 studies were interpreted within 3 years with an average TAT of 3 days. 19 hours. The study emphasises on possibility and potentials of teleradiology in establishing the quality and timeliness of radiological services for rural populations, thus addressing the issue of specialist manpower shortage.

Relevance to this thesis: Hence, this paper is important as it outlines the actual example of teleradiology implementation in the rural environment of India, as well as the use of this approach to decrease the gap in the diagnostics accessibility and time for patients. Methodology, the problem encountered and the achievement registered in the study can be of immense use for designing and implementing similar teleradiology projects in Ghaziabad.

3.25 Rackimuthu, Sudhan, Mohammad Mehedi Hasan, Ishita Ray, Abdul Moiz Sahito, Pranshu Chawla, and Diya Ghosh. "Teleradiology in India during the COVID-19 Pandemic: Merits, Pitfalls and Future Perspectives." Health Policy and Planning 37, no. 9 (October 12, 2022): 1203–6.

This paper aims at providing the use of remote radiology in India during the COVID-19 outbreak, the advantages, challenges and prospects of teleradiology. The authors follow this up by stressing the relevance of teleradiology in the sustainable delivery of vital healthcare services bearing in mind the effects of the pandemic in the densely-populated India and the comparatively strained healthcare systems. The article explains more about the Indian government's telemedicine programme called "eSanjeevani" that is providing online consultations, while another platform that allows real-time sharing of images is known as "CollabDDS". The authors also point out the advantages of teleradiology such as increased opportunities for consulting with specialists, faster examination, lower prices as well as higher levels of patients' services, especially in rural areas. They also pinpoint some of the stumbling blocks like inadequate facilities, low health practitioners' awareness, urban and rural disparity and financing. The author thus concludes that the future of teleradiology is still bright in India, especially if there is increased investment in infrastructure, technology and training with the aim of realizing these enormous benefits.

Relevance to this thesis: Hence, this paper is important as it outlines a modern view on teleradiology in India by focusing on its importance during the COVID-19 pandemic as well as its potential in resolving some of the issues of healthcare inequalities in the rural areas such as Ghaziabad. The information on governmental actions and opportunities and threats indicated is useful for defining how teleradiology developed in India and how it will evolve in the future.

3.26 Kalyanpur, Arjun, Harish T S Nair, and Neetika Mathur. "Teleradiology Service Is Indispensable in the Indian Healthcare Sector." International Journal of Health Technology and Innovation 2, no. 02 (August 17, 2023): 24–27.

This paper aims at providing the future of the Indian healthcare industry, along with the benefits that may be provided for healthcare providers and patients as well as radiologists is illustrated in this article. The authors point out that India has limited numbers of radiologists especially in the rural regions, however, there is a continuing demand for diagnostic imaging year in and year out. Using the knowledge of the subject area, supported by the ideas outlined in the article, the definition of components of an ideal supplier was developed and identified as follows: infrastructural support, quality assurance, security measures, innovative solutions, cost/performance efficiency and cooperation. The authors believe that innovation including the use of state-of-the-art technologies including cloud-based PACS systems, AI algorithms, and mobile applications will assist in improving efficiency, accuracy, and accessibility of services that are given through teleradiology. They also place significant emphasis on ethical concerns, patients' confidentiality and protection of their data in the practice of teleradiology.

Relevance to this thesis: Hence, this paper is important as it outlines the use of teleradiology to solve health inequality in India. The presentation of key factors affecting an ideal teleradiology

service provider is helpful in considering the relative components of the successful implementation of teleradiology in the given area, such as Ghaziabad.

3.27 Grewal, Harpreet, Niharika Prasad, Gagandeep Dhillon, and Rahul Kashyap. "Teleradiology and the Compensation Conundrum in India." Cureus, December 30, 2023.

This paper aims at providing a look on how teleradiology services are practised in teleradiologists in India and the process and evaluates the remuneration systems that currently exist and are inadequate to support the increasing demand for the practice of teleradiology. The authors are very receptive to the effectiveness of teleradiology in increasing healthcare delivery in several districts of India. They bring up the issue of remunerations of educated Indian radiologists to foreign-trained radiologists and how scans from top-ranking developed countries are outsourced to India at a lower price. The authors state that this position erodes the image of Indian-trained radiologists as well as the quality of interpretation since radiologists might be overwhelmed by workloads which could result in fatigue.

Relevance to this thesis: Hence, this paper is important as it outlines an important question of the implementation of teleradiology and, in particular, the means for ensuring reasonable and viable payment for teleradiologists. Although the article presents an analysis in the larger Indian setting it offers important lessons for this thesis because it discusses how substandard compensation could affect the quality and viability of teleradiology services especially in regions like Ghaziabad.

3.28 Kalyanpur, Arjun, Pallavi Rao, and Neetika Mathur. "Utilization of Teleradiology by Intensive Care Units: A Cohort Study." Indian Journal of Critical Care Medicine 28, no. 1 (December 31, 2023): 20–25.

This paper aims at providing the cohort study of teleradiology service use in ICU in 80 hospitals across the United States and examines how use of teleradiology for timely image interpretation affects patient care and management. A cross-sectional study was carried out in 22, 081 imaging studies interpreted by ABCRs the teleradiology service provider firm is based in India. The study showed that most of the imaging tests carried out for the ICU patients were CT and radiograph with the majority of the studies done at night. The mean TAT for reporting was under fifty minutes throughout the research day fortunately. The authors conclude that teleradiology is able to decrease the interval to intervention time thus improving on patient care management in the ICUs. They also point to the time leverage of teleradiology such that compensates for the scarcity of the on-site radiologists especially in off-peak periods.

Relevance to this thesis: Hence, this paper is important as it outlines the US healthcare system, generalizable findings pertaining to the application of teleradiology in ICUs for timely diagnosis and treatment are presented. The studies indicate that similar benefits could be achieved in case the teleradiology services are established in the Intensive Care Units in India hence enhancing critical care in Ghaziabad rural region.

3.29 Ramakrishnan, Nagarajan. "Teleradiology: Geography Is Now History!" Indian Journal of Critical Care Medicine 28, no. 1 (December 31, 2023): 1–2.

This paper aims at providing the extent to which teleradiology can actually break geographical barriers and revolutionise the delivery of healthcare, especially in critical care. The author illustrates actual examples of cases when Indian teleradiologists are actually offering their services to hospitals in the United States further illustrating the global applicability of this technology. Editorial teleradiology is used for tele-ICU services as a means of achieving timely interpretation of imaging studies for critically ill patients and coping with a shortage of specialists during off-duty time. Here, the author rightly states that it is high time India made use of this technology in striving to enhance crucial care ailments in its healthcare system particularly in the rural environment. The authors ends by embracing the aspects of digital change like telemedicine, and Artificial Intelligence by observing that these are not the future of health care but the present requirements of the future healthcare sector.

Relevance to this thesis: Hence, this paper is important as it outlines a picture of how teleradiology can be used to address some of the existing gap in access to health care and thus take critical care services a notch higher, especially in the rural settings of India. The author's point of view is a direct connection to this thesis since it captures the possibility of how teleradiology could revolutionise the healthcare sector in Ghaziabad and possibly other areas.

3.30 Chandramohan, Anuradha, Viswajit Krothapalli, Ann Augustin, Madhavi Kandagaddala, Hannah Mary Thomas, Thambu David Sudarsanam, Ammar Jagirdar, Shalini Govil, and Arjun Kalyanpur. "Teleradiology and Technology Innovations in Radiology: Status in India and Its Role in Increasing Access to Primary Health Care." The Lancet Regional Health - Southeast Asia 23 (April 2024): 100195.

This paper aims at providing the identification of technology instruments with regard to imaging accessibility in primary care in India, enablers and constraints, and the gap in knowledge about technology interventions. Of these, 43 papers published in the journals and 52 non-academic materials from 2005 to 2022 were reviewed which included discussion related to teleradiology, mobile digital imaging vehicles, artificial intelligence, mobile gadgets and applications, data security, web applications, government and private, cost aspect. The authors have presented the data which accomplished the fact that teleradiology, with the help of mobile digital imaging units and artificial intelligence, can assist in mitigating radiologist deficiency and strengthen the screening and emergency programs. However, they use the absence of data of teleradiology networks, definition of requirements, costs and comparative analysis of the effectiveness of barriers and drivers to enable implementation in the primary care sectors.

Relevance to this thesis: Hence, this paper is important as it outlines a clear definition of the concept of teleradiology as well as details of the development of teleradiology and technological advancement in India with respect to access to primary health care. The perceived knowledge gaps and ambiguity in the regulations are most helpful for demarcating the research query and objective of this thesis with reference to the rural region of Ghaziabad.

CHAPTER - 4

METHODOLOGY

4.1 Study Design

A cross-sectional survey to evaluate knowledge and awareness of teleradiology among the general population living in the rural villages near Ghaziabad city in Uttar Pradesh.

Study Area

The study was conducted in the villages located in rural Ghaziabad, Uttar Pradesh, India. These villages were selected due to:

- Limited Access to Specialized Healthcare Services.
- Challenges in Accessing Radiology Services.
- Absence of Tele-radiology Initiatives.

4.2 Study Population

The target population for this study was the general adult population (**aged 18 years or older than 18 years)** residing in the selected villages, regardless of gender, education level, or occupation.

4.3 Sample Size

A total of sample size **402** individuals participated in the study. This sample size was deemed sufficient to provide a representative understanding of knowledge and awareness levels within the selected villages, considering the limited population size of rural communities.

4.4 Data Collection Protocol

Primary data was collected with the help of a questionnaire which was constructed in English as well as Hindi (provided in Appendix A). The questionnaire comprised 15 questions, covering the following sections:

1. Demographic and Socioeconomic Information
2. Knowledge and Awareness About Teleradiology
3. Existing Access to Radiology Services
4. Concerns About Using Technology for Healthcare

4.5 Data Collection Methods

- **Survey:** The online version of the questionnaire was created using Google Forms and distributed through social media platforms relevant to the villages, including individually and village leader's WhatsApp Group. Participants were encouraged to complete the survey at their convenience using their smartphones or computers (if they have) with internet access.

4.6 Data Analysis

All the responses to the questionnaire items that includes closed-ended multiple-choice questions were analyzed using descriptive statistics. In order to further analyze the results, the frequency and the proportion for each of the response based on the given question were computed to give a detailed overview of the results. Data was organized and analyzed using Google Sheets for both online and offline and visualized using bar charts and Frequency tables.

- **Quantitative Data**: Descriptive statistics such as averages and totals were used to summarize demographic information and responses to the multiple-choice questions. Frequencies and percentages were calculated for each response.
- **Data Visualization**: Frequency tables and Bar charts were used to visualized for a clear and concise representation of the results.

- **Software Used**: Microsoft Excel/Google Sheets was used for data collection that was linked with Google Forms for Online Questionnaires and for offline Questionnaires, results were also collected in the Google Sheets/Microsoft Excel.

4.7 Selection Criteria

- **Inclusion Criteria:**
    - Residents of the selected rural areas in Ghaziabad, U.P.
    - Age 18 years or older18 years.
- **Exclusion Criteria:**
    - Individuals who are unable or unwilling to provide informed consent.
    - Individuals with cognitive impairments that prevent them from understanding or completing the survey.

4.8 Ethical approval

Ethical approval for this study will be obtained from the Institute of Santosh Medical College and Hospital before commencing data collection. All data collection procedures will adhere to the ethical guidelines and principles approved by the Institute.

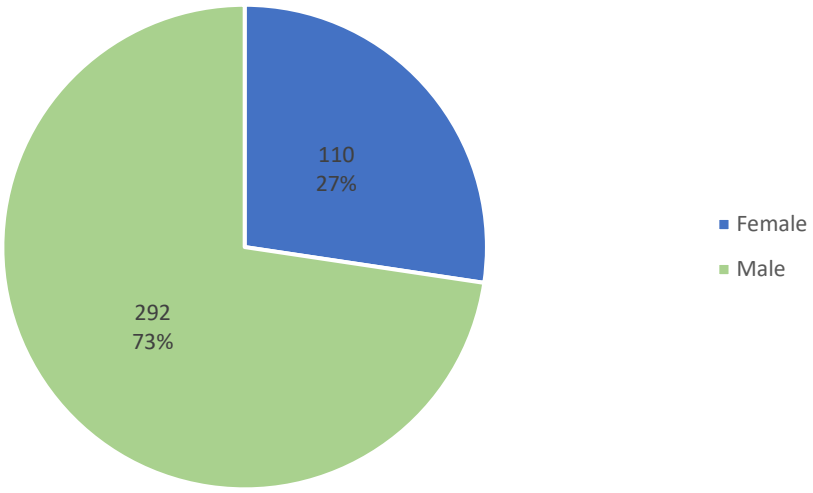
CHAPTER - 5

RESULTS

This study helps to evaluate the knowledge and awareness of teleradiology among the general population in the rural villages of Ghaziabad, Uttar Pradesh, India.

All the people answered all the questions in the survey. In total, **402** people took part. The survey showed a big gender difference, with 292 men (72.6%) and 110 women (27.4%) answering.

Graph 1 Shows the Gender Distribution.



According to the **Graph 1**, there are a lot more men than women who took part. About 72.6% were men, while only 27.4% were women. This means that there are many more men in the study compared to women.

Table 1 Shows the Age-Group Distribution.

Age Group	Frequency	Percentage (%)
18-30 years	156	38.8
31-45 years	97	24.1
46-60 years	146	36.3
61 years or older	3	0.7
Total	402	

According to **Table 1**, most people who answered the survey were between 18 and 30 years old, making up 38.8%. Another group, 24.1%, was between 31 and 45 years. The biggest group of people were between 46 and 60 years old, and they made up 36.3% of everyone who took part. Only a very small number of people, 0.7%, were older than 61 years.

Graph 1. Shows the Age-Group Distribution for the participants.

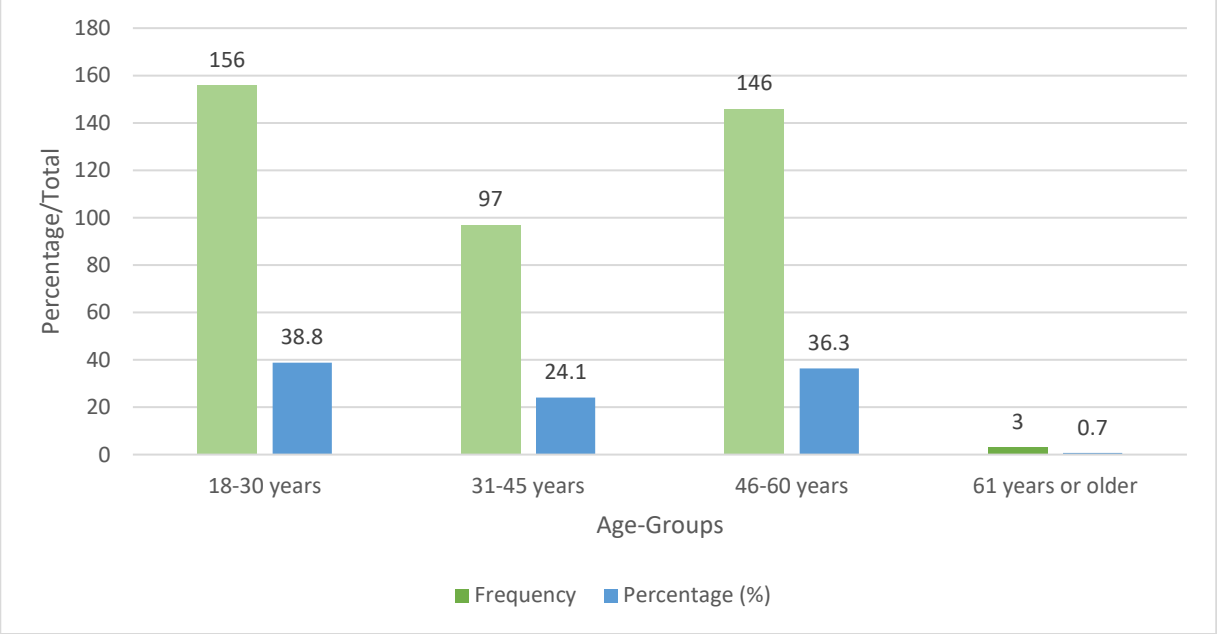
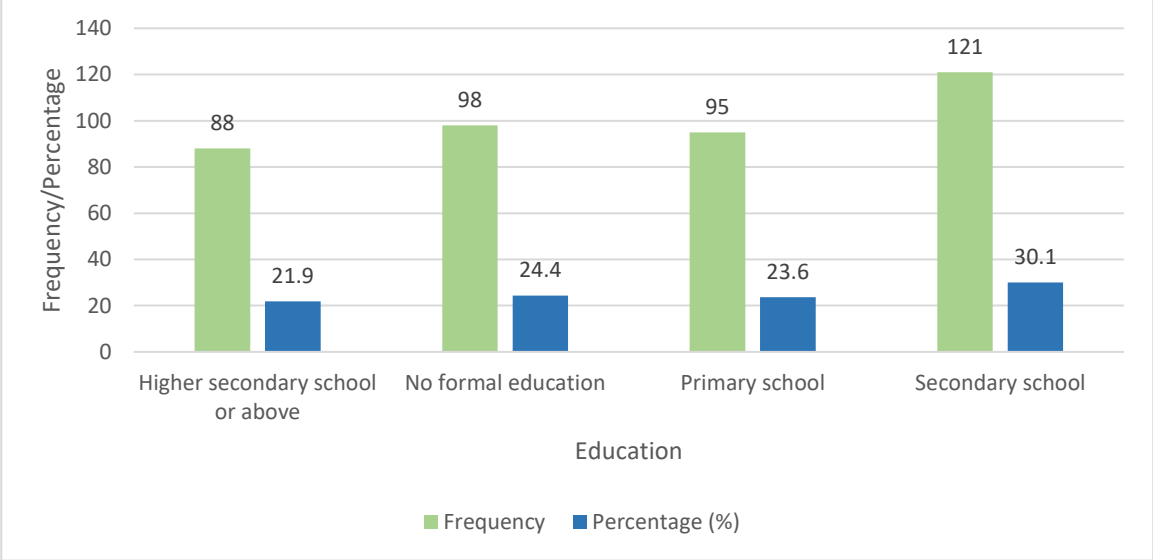


Table 2 Shows the Highest Education Level.

Education	Frequency	Percentage (%)
Higher secondary school or above	88	21.9
No formal education	98	24.4
Primary school	95	23.6
Secondary school	121	30.1
Total	402	

According to **Table 2**, most people said "Secondary school" was the highest level of education they finished, with 30.1% of the total. Many others had "No formal education" or only finished "Primary school," making up 24.4% and 23.6% of the people, respectively. A smaller group, 21.9%, said they finished "Higher secondary school or above".

Graph 2 Shows the Highest Education Level



The education levels in these villages show many people not have much formal schooling. This thing is important when we want to make teleradiology popular. How much someone study can

affect how well they understand to use technology, learn hard ideas, and feel good using new machines or tools. This makes it difficult for them to use things like teleradiology easily.

Table 3 Shows the Teleradiology Awareness and Understanding Among Survey Participants

S. No.	Questions	Options	Frequency	Percentage (%)
4.	How long have you been living in this village/area?	11-20 years	98	24.4
		5-10 years	101	25.1
		Less than 5 years	117	29.1
		More than 20 years	86	21.4
5.	Have you heard of the term 'teleradiology'?	No	197	49
		Yes	205	51
6.	If you have heard of teleradiology, can you explain in your own words what it is?	Getting medical advice from a doctor over the phone.	15	3.7
		Having a surgery performed remotely using robots.	21	5.2
		I don't know how to explain it.	353	87.8
		Sending medical images like X-rays over the	13	3.2

		internet for a doctor to look at.		
7.	Are you aware of any teleradiology services currently available in or near this village/area?	No	279	69.4
		Yes	123	30.6

According to the **Table 3** the people who answer the survey, they stay in their village at different time. Most say they live there for "Less than 5 years" (29.1%). Then some people stay for "5-10 years" (25.1%), and others for "11-20 years" (24.4%). Last, 21.4% of people live there for "More than 20 years".

Only 51% of the people know about the word "Teleradiology."

Out of those who hear about teleradiology, 87.8% cannot explain what it means. Some people think wrong. Like, 6.4% think it is to get medical advice by phone, and 9% believe it is surgery done by robots from far. Only 3.2% people explain it right.

Most people, 69.4%, do not know if there is any teleradiology service in or near their village.

Table 4 Shows the Perceived Benefits of Teleradiology for Healthcare.

Perceived Benefits	Frequency	Percentage (%)
No	204	50.7
Yes	198	49.3
Total	402	

According to the **Table 4,** About 49.3% of the people who answered the survey think that teleradiology can help healthcare in their village or area. On the other hand, 50.7% of the people do not believe that teleradiology would be useful for them.

Graph 3 Shows the Perceived Benefits of Teleradiology for Healthcare.

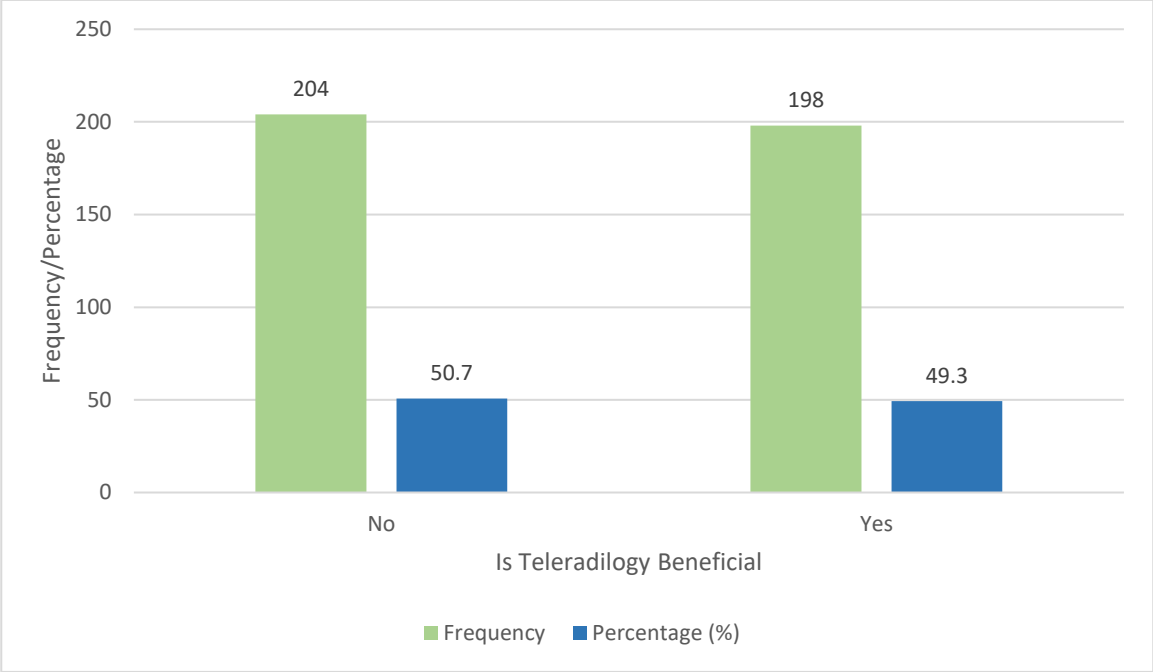


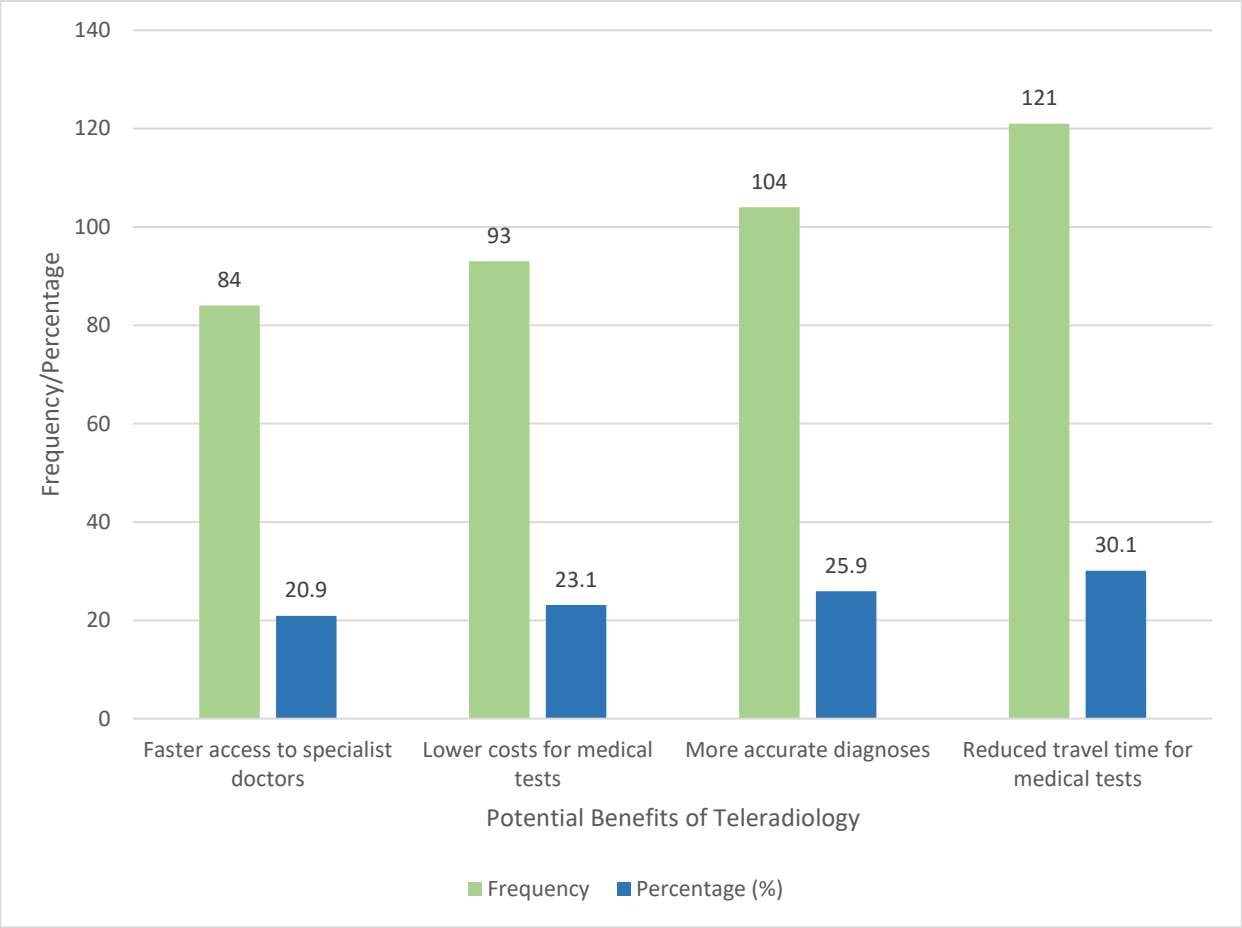
Table 5 Shows the Potential Benefits of Teleradiology as Perceived by Survey Participants.

Potential Benefits	Frequency	Percentage (%)
Faster access to specialist doctors	84	20.9
Lower costs for medical tests	93	23.1
More accurate diagnoses	104	25.9
Reduced travel time for medical tests	121	30.1

According to the **Table 5**, most people see "Reduced travel time for medical tests" as the biggest benefit of teleradiology, with 30.1% choosing this. Other benefits mentioned were "More accurate

diagnoses" (25.9%), "Lower costs for medical tests" (23.1%), and "Faster access to specialist doctors" (20.9%).

Graph 4 Shows the Potential Benefits of Teleradiology as Perceived by Participants.



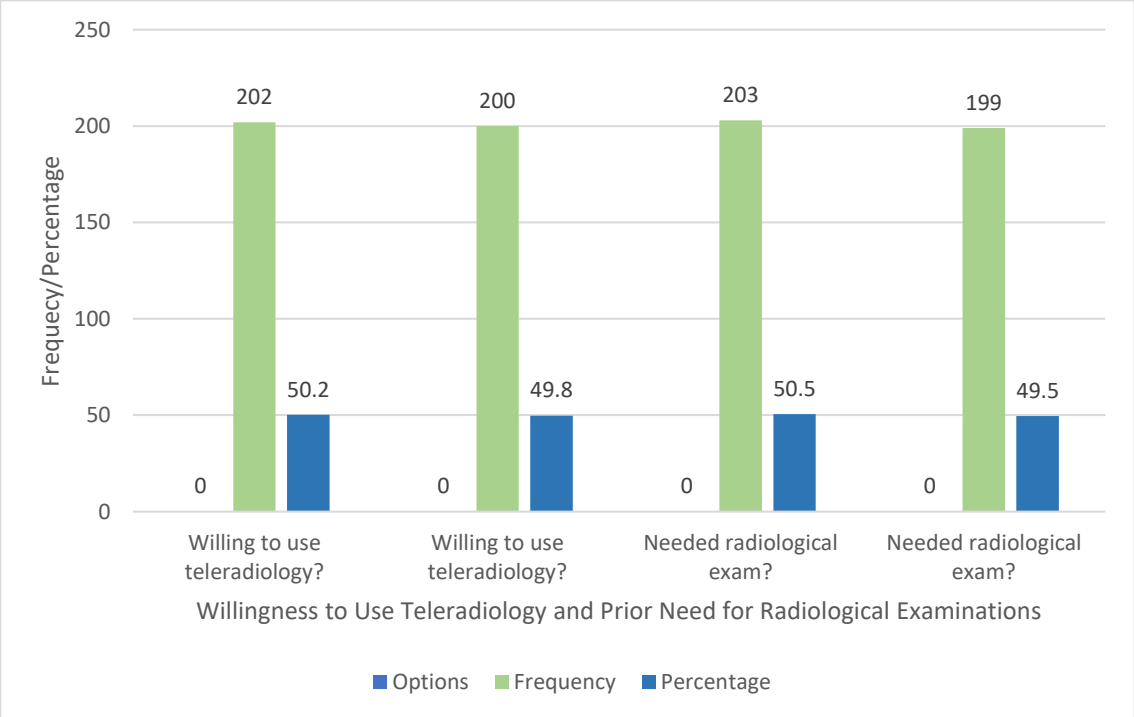
Teleradiology can reduce travel, which is a big help. People also believe it will give more correct diagnoses because it connects them to better doctors and machines in cities. Also, lower cost and faster care show that teleradiology can make healthcare cheaper and easier for rural people. The next table shows the willingness that a must to understand after the potential benefits.

Table 6 Shows the Willingness to Use Teleradiology and Prior Need for Radiological Examinations among Participants

S.No.	Question	Options	Frequency	Percentage (%)
10.	Would you be willing to use teleradiology services if they were available in or near this village/area?	No	202	50.2
		Yes	200	49.8
11.	Have you ever needed a radiological examination (X-ray, CT scan, MRI, etc.)?	No	203	50.5
		Yes	199	49.5

According to the **Table 6** about 49.8% of people said they are ready to use teleradiology services if they are available, while 50.2% said they are not willing.

Graph 5 Willingness to Use Teleradiology and Prior Need for Radiological Examinations Among Participants



And about half of the people (50.5%) said they needed radiology exams before in their life, while the other half (49.5%) never needed one.

The data show that people are almost evenly split in whether they want to use teleradiology or not, and also in whether they needed radiology before or not.

Table 7 Shows the Current Access to Radiology Services

S.No.	Question	Options	Frequency	Percentage (%)
12.	Where did you go for your last radiological examination?	Diagnostic center	95	23.6
		Government hospital	92	22.9
		I have never had a radiological examination	87	21.6
		Private hospital	128	31.8
13.	How far did you have to travel to get your last radiological examination?	11-20 kilometers	102	25.4
		5-10 kilometers	100	24.9
		Less than 5 kilometers	109	27.1
		More than 20 kilometers	91	22.6

14.	In your opinion, how can access to radiology services in this village/area be improved?	Better transportation options to reach radiology centers	97	24.1
		Having a radiology center closer to the village	113	28.1
		More affordable services	89	22.1
		Shorter waiting times at radiology centers	103	25.6

According to the **Table 7,** Out of those who had radiology exams before, most went to a "Private hospital" (31.8%), then to a "Government Hospital" (22.9%) or a "Diagnostic center" (23.6%). About 21.6% said they never had a radiology exam before.

The distance people travelled for their last radiology exam was different. The most common answer was "Less than 5 kilometers" (27.1%). But many people had to travel farther, with 25.4% going 11-20 kilometers, 24.9% going 5-10 kilometers, and 22.6% traveling more than 20 kilometers.

The most common idea for making radiology better was "Having a radiology center closer to the village" (28.1%). People also wanted "Shorter waiting times at radiology centers" (25.6%). Other ideas were "Better transportation options to reach radiology centers" (24.1%) and "More affordable services" (22.1%).

People also want shorter waiting times and cheaper services, meaning that cost and waiting are big problems. It seems they have to wait long at the current places, and the cost of traveling and doing the radiology test is hard for them to afford.

Table 8 Shows the Concerns About Using Technology for Healthcare Among Survey Participants.

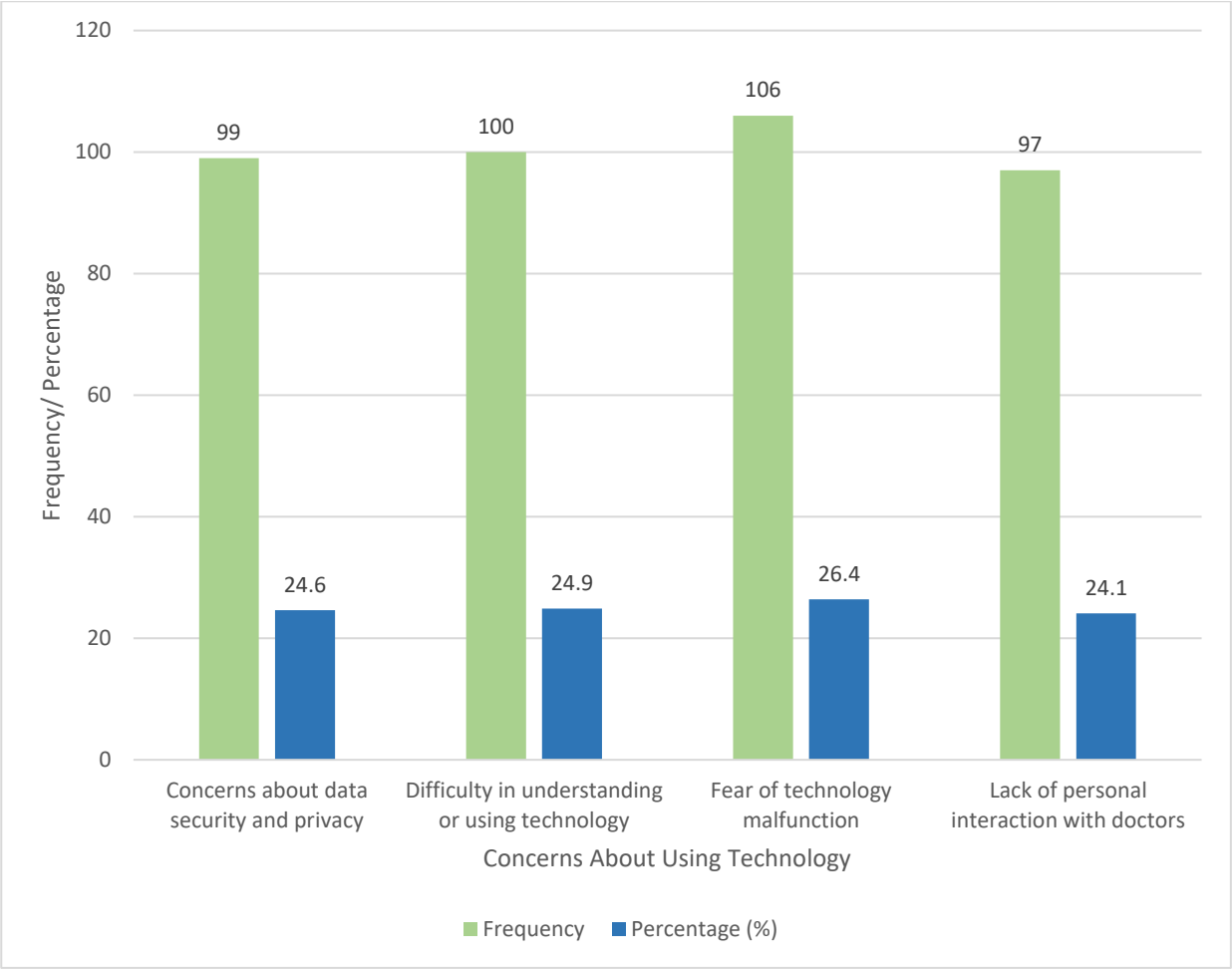
Options	Frequency	Percentage (%)
Concerns about data security and privacy	99	24.6
Difficulty in understanding or using technology	100	24.9
Fear of technology malfunction	106	26.4
Lack of personal interaction with doctors	97	24.1

According to the **Table 8**, that people have many concerns about using technology for healthcare. Most people, 26.4%, say they fear "Technology might not work properly." Then, 24.6% of people are worried about "Safety of their data and privacy." Also, 24.9% of people find it "Hard to understand or use technology," and 24.1% worry because there is "No personal interaction with doctors."

Many are also scared their private medical information not safe, so we must protect their data and tell them how it will be safe. Even if teleradiology is good, people still want to talk with doctors face-to-face, so we should offer video calls and involve local health workers to build trust. Also, many people don't know how to use technology well, so we must teach them how to use computers and phones for healthcare.

And this question concludes our Questionnaire.

Graph 6 Shows Concerns About Using Technology for Healthcare Among Survey Participants



So, the survey results show that people in rural Ghaziabad have mixed feelings about teleradiology. Some people know about it, but many do not understand well how it works, which means there is a big need for awareness about it. People see that teleradiology can help by reducing travel and making it easier to reach expert doctors, but many are still unsure about using it. This is mostly because they worry about the technology, keeping their data private, and not talking to doctors face-to-face. These results show that to make teleradiology work, we need to teach people how to use it, build trust, focus on patients, and help those who are not used to technology.

CHAPTER - 6

DISCUSSION

This study is important because it tells us what people in these villages think about teleradiology. By focusing on Ghaziabad and understanding what people think, their knowledge, and the problems they face, this research helps us plan better ways to promote teleradiology. Now, we have a clearer idea of what needs to be done to make teleradiology work for them.

This study found that how much people in the rural villages in Ghaziabad, Uttar Pradesh, know about Teleradiology and what they think about it. While other research talks about the problems of getting special healthcare in rural India (this Paper [17], Kalyanpur et al. 2023), most studies focus on cities or give general information. Our study is different because it looks closely at these villages and shows the real situation in rural Ghaziabad.

One big finding is the importance of internet access and knowing how to use it, for making teleradiology successful. Also, even people who know the word "Teleradiology" don't always understand it well. Only 3.2% could explain it correctly. This matches what this Paper [18] says about the need for clear information and shows how much we need simple teaching materials for people in rural areas who don't know much about technology.

Even though people don't fully understand teleradiology, our study, like other research Paper [19], shows that people in villages see the good things teleradiology can do, like helping them travel less, seeing specialist doctors, and getting better diagnoses. But our study goes further by looking at why some people don't want to use teleradiology. Almost half of the people said they wouldn't

[17] Kalyanpur, Arjun, Harish T S Nair, and Neetika Mathur. "Teleradiology Service Is Indispensable in the Indian Healthcare Sector." International Journal of Health Technology and Innovation 2, no. 02 (August 17, 2023): 24–27.
[18] Rackimuthu, Sudhan, Mohammad Mehedi Hasan, Ishita Ray, Abdul Moiz Sahito, Pranshu Chawla, and Diya Ghosh. "Teleradiology in India during the COVID-19 Pandemic: Merits, Pitfalls and Future Perspectives." Health Policy and Planning 37, no. 9 (October 12, 2022): 1203–6.
[19] Kalyanpur, Arjun, and Srikrishna Seshadri. "Teleradiology in India - Utilisation, Benefits and Challenges." International Journal of Telemedicine and Clinical Practices 1, no. 3 (2016): 209.

use it, which is like what this Paper [20] says, that "just knowing about teleradiology is not enough to make people use it."

We found that people are worried about keeping their private information safe, if the technology will work, and not getting to talk to doctors face-to-face. This adds to what other studies like Paper [21], and Paper [20] say, but our study gives more real numbers about how common these worries are in rural areas.

By focusing on rural villages and talking directly to the people, our study gives important data to help make better plans for teleradiology in Ghaziabad. If we focus on the needs of the people, close the "digital divide," and give clear, easy-to-understand information, we can make healthcare fairer and help people in rural areas get better health services.

[20] Chandramohan, Anuradha, Viswajit Krothapalli, Ann Augustin, Madhavi Kandagaddala, Hannah Mary Thomas, Thambu David Sudarsanam, Ammar Jagirdar, Shalini Govil, and Arjun Kalyanpur. "Teleradiology and Technology Innovations in Radiology: Status in India and Its Role in Increasing Access to Primary Health Care." The Lancet Regional Health - Southeast Asia 23 (April 2024): 100195.
[21] Grewal, Harpreet, Niharika Prasad, Gagandeep Dhillon, and Rahul Kashyap. "Teleradiology and the Compensation Conundrum in India." Cureus, December 30, 2023.

CHAPTER - 7

CONCLUSION

This study looks at how much people in rural Ghaziabad know about teleradiology, what they think about it, and what stops them from using it. These villages are now between old ways and new technology. People can see that teleradiology might help healthcare, like 30.1% said it will save travel time, and 25.9% said it can give better diagnoses. But to make this happen, we need a strong plan.

In our survey, only 51% of people heard the word "teleradiology," and just 3.2% could explain it right. Almost 70% did not know if any teleradiology service is in their area. This shows that there is a big need to fix the technology gap in rural India and teach people in easy ways so they understand what teleradiology is and how it can help.

Even though people know the benefits, 50.2% do not want to use teleradiology. Most of them worry about the safety of their information (24.6%), that the technology might not work (26.4%), and not getting to talk to doctors directly (24.1%). This shows that we need to build trust by making sure the technology works well and protects their private data, while also keeping some personal contact in healthcare.

Teleradiology can change healthcare in rural Ghaziabad, but we need to think about not just the technology but also about the social, cultural, and money problems people face. By making sure everyone can use it, making it easy to get, and keeping it affordable, by running awareness campaigns in the villages and the government and healthcare providers can help people in the villages accept Teleradiology by explaining how Teleradiology works. This can help close the healthcare gap and make the future fairer and healthier for everyone.

CHAPTER - 8

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ANNEXURES

SANTOSH DEEMED TO BE UNIVERSITY (GHAZIABAD)

INFORMED CONSENT ENGLISH

NAME OF RESEARCHER: KM REETU RANA (MSc. MIT, Postgraduate student)

[E-mail: reeturana077@gmail.com] [Contact: +91-9045891384]

I…… voluntarily agree to take part in this research.

"Evaluation of Knowledge and Awareness about Tele-Radiology in Rural Areas of Ghaziabad, U.P., India"

- I understand that even if I agree to take part now, I can stop at any time or choose not to answer any question, and there will be no consequence of any type.

- The purpose and details of the study were explained to me, and I was also given the chance to ask questions about the study.

- I have been informed that there will be no benefits to participating in this study.

- My identity will be kept private. They will change my name and hide any details I give, so no one will know who I am or the people I mention.

- In case of the participant's inability to read: The researcher has done an accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions.

---------- ----------

Signature /Thumbprint of researcher Participant Date

LETTER OF ETHICAL CLEARANCE FOR DISSERTATION FROM REGISTRAR OFFICE

SANTOSH
Deemed to be University
(Established u/s 3 of the UGC Act, 1956)

F. No. SU/R/2024/1344[47] Dated: 17.05.2024

Subject: Grant of Ethical Clearance for **Dissertation Protocol** Topic **"Awareness about TeleRadiology in a Rural Area",** submitted by **KM REETU RANA,** student of M.Sc Medical Imaging Technology, 2022 Batch.

*****

With reference to the request for grant of Ethical Clearance for the Dissertation Protocol entitled **"Awareness about TeleRadiology in a Rural Area"**, **KM REETU RANA** is informed that the **Dissertation Protocol** submitted by him/her was considered by the **Screening Committee** of the **Allied Health Sciences** in its meetings held on 07.02.2024 and 29.02.2024. The recommendations of the **Screening Committee** were considered in detail by the **Institutional Ethics Committee** in its meeting held on **15.05.2024** and the same was **approved** by the **Ethics Committee** of the **Santosh Deemed to be University, Ghaziabad, Delhi NCR**.

He /She is informed accordingly for further necessary action.

17/5/24

[Dr. EZHILRAJAN. K]
REGISTRAR

SANTOSH DEEMED TO BE UNIVERSITY REGISTRAR GHAZIABAD, NCR DELHI

KM REETU RANA
M.Sc Medical Imaging Technology.

Copy to:

1. The Vice Chancellor
2. The Dean – Academics
3. The Dean, SMC&H
4. The Dean – Research
5. The Director - IQAC
6. HOD/ Course In-charge of the concerned Department.

APPENDIX – I

QUESTIONNAIRE

Evaluation of Knowledge and Awareness about Tele-Radiology in a Rural Area in Ghaziabad U.P.

Please choose the best answer for each question.

1. **What is your age group?**

   a) 18-30 years

   b) 31-45 years

   c) 46-60 years

   d) 61 years or older

2. **What is your gender?**

   a) Male

   b) Female

3. **What is your highest level of education?**

   a) No formal education

   b) Primary school

   c) Secondary school

   d) Higher secondary school or above

4. **How long have you been living in this village/area?**

   a) Less than 5 years

   b) 5-10 years

c) 11-20 years

d) More than 20 years

5. **Have you heard of the term "teleradiology"?**

   a) Yes

   b) No

6. **If you have heard of teleradiology, can you explain in your own words what it is?**

   a) Sending medical images like X-rays over the internet for a doctor to look at.

   b) Getting medical advice from a doctor over the phone.

   c) Having a surgery performed remotely using robots.

   d) I don't know how to explain it.

7. **Are you aware of any teleradiology services currently available in or near this village/area?**

   a) Yes

   b) No

8. **Do you think teleradiology can be beneficial for healthcare in this village/area?** a) Yes

   b) No

9. **Which of the following do you think are potential benefits of teleradiology?**

   a) Reduced travel time for medical tests

   b) Lower costs for medical tests

c) Faster access to specialist doctors

d) More accurate diagnoses

10. **Would you be willing to use teleradiology services if they were available in or near this village/area?**

a) Yes

b) No

11. **Have you ever needed a radiological examination (X-ray, CT scan, MRI, etc.)?** a) Yes

b) No

12. **Where did you go for your last radiological examination?**

a) Government hospital

b) Private hospital

c) Diagnostic center

d) I have never had a radiological

13. **How far did you have to travel to get your last radiological examination?**

a) Less than 5 kilometers

b) 5-10 kilometers

c) 11-20 kilometers

d) More than 20 kilometers

14. **In your opinion, how can access to radiology services in this village/area be improved?**

    a) Having a radiology center closer to the village

    b) More affordable services

    c) Better transportation options to reach radiology centers

    d) Shorter waiting times at radiology

15. **What are your main concerns about using technology for healthcare?**

    a) Lack of personal interaction with doctors

    b) Difficulty in understanding or using technology

    c) Concerns about data security and privacy

    d) Fear of technology malfunction.

MASTER CHART

Tasks	Tasks Duration	Start Date	End Date	Aug-Sep	Oct-Nov	Dec-Jan	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep
Preparation of Thesis proposal	29	03-08-23	01-09-23							
Presentation of Thesis proposal	19	02-09-23	21-09-23							
Preparation & Submission Thesis Application in Ethics Committee	44	05-09-23	18-10-23							
Review of Literature	87	25-10-23	19-01-24							
Data Collection	17	24-08-24	09-09-24							
Data Analysis	2	09-09-24	10-09-24							
Report Writing	13	11-09-24	23-09-24							
Submission of Thesis	1	24-09-24	25-09-24							
Presentation of Thesis	0									

EVALUATION OF KNOWLEDGE AND AWARENESS ABOUT TELE-RADIOLOGY IN RURAL AREAS OF GHAZIABAD, U.P., INDIA

ORIGINALITY REPORT

3%
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